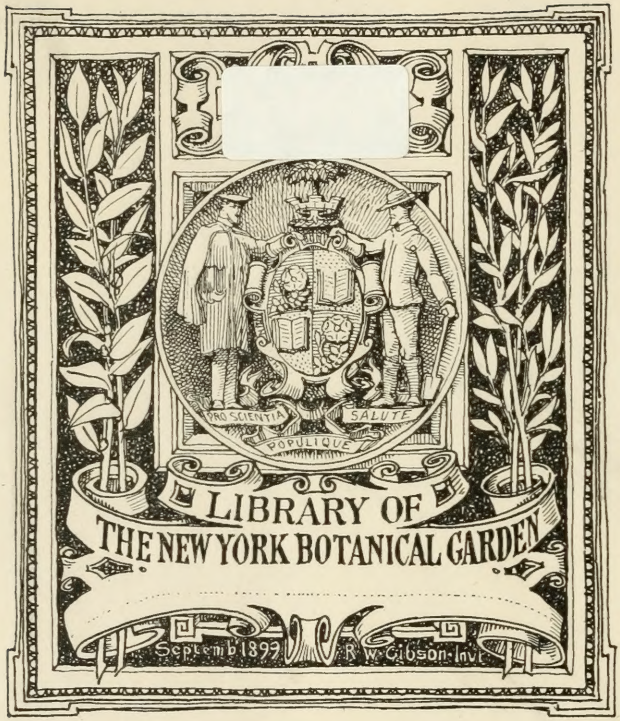
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TWENTY-SIXTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

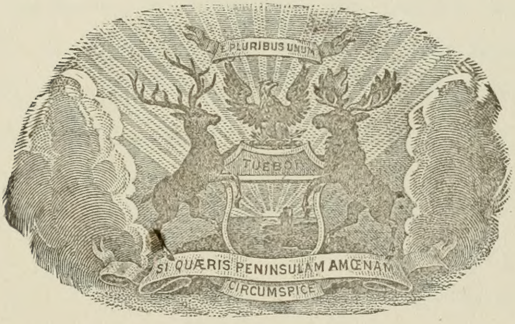
STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN,

FROM

OCTOBER 1, 1886, TO JUNE 30, 1887.



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REPORT OF THE SECRETARY

OF THE

STATE BOARD OF AGRICULTURE.

Agricultural College,
July 1, 1887.

To Cyrus G. Luce,

Governor of the State of Michigan:

Sir,—I have the honor, in compliance with the law approved May 21, 1887, changing the termination of the fiscal year from September thirtieth to June thirtieth, to submit to you herewith, as required by statute, the accompanying report for the nine months ending June 30, 1887, with supplementary papers.

Very respectfully,

HENRY G. REYNOLDS,

Secretary of the State Board of Agriculture.

STATE BOARD OF AGRICULTURE.

	Term expires.
Hon. FRANKLIN WELLS, Constantine	1891
President of the Board.	
Hon. WM. B. McCREERY, Flint	1893
Hon. ELIJAH W. RISING, Davison Station	1889
Hon. HENRY CHAMBERLAIN, Three Oaks	1889
Hon. GEO. B. HORTON, Fruit Ridge	1891
Hon. CHAS. W. GARFIELD, Grand Rapids	1893

Hon. CYRUS G. LUCE, Governor of the State, } *Ex-Officio.*
Hon. EDWIN WILLITS, M. A., President of the College, } *Ex-Officio.*

HENRY G. REYNOLDS, M. S., Agricultural College, Secretary.

BENJAMIN F. DAVIS, Lansing, Treasurer.

FACULTY AND OFFICERS OF THE STATE AGRICULTURAL COLLEGE.

Edwin Willits, M.A., President and Professor of Political Science, Constitutional Law and Business Law.
Theophilus C. Abbot, LL. D., Professor of Mental Philosophy and Logic.
Robert C. Kedzie, M.A., M.D., Professor of Chemistry and Curator of the Chemical Laboratory.
Albert J. Cook, M.S., Professor of Zoölogy and Entomology and Curator of the General Museum.
Wm. J. Beal, M.A., M S., Ph. D., Professor of Botany and Forestry and Curator of the Botanical Museum.
Rolla C. Carpenter, M.S., C.E., Professor of Mathematics and Civil Engineering.
Samuel Johnson, M.S., Professor of Practical Agriculture and Superintendent of the farm.
Elias J. MacEwan, M.A., Professor of English Language and Literature.
E. A. A. Grange, V.S., Professor of Veterinary Science.
John A. Lockwood, M.S., Second Lieutenant Seventeenth U. S. Infantry, Professor of Military Science and Tactics.
Liberty H. Bailey, Jr., M.S., Professor of Horticulture and Landscape Gardening, and Superintendent of the Horticultural Department.
*Lewis McLouth, M.A., Ph. D., Professor of Mechanics and Astronomy.
Henry G. Reynolds, M.S., Secretary.
W. F. Durand, U. S. N. A., Professor of Mechanics and French, and Director of the Shops.
Frank S. Kedzie, M.S., Assistant Professor of Chemistry.
Louis G. Carpenter, M.S., Assistant Professor of Mathematics.
Henry R. Pattengill, B.S., Assistant Professor of English.
Henry W. Baird, B.S., Ass't Secretary and Instructor in Book Keeping.
Joseph B. Cotton, B.S., Instructor in Mathematics.
William S. Holdsworth, B.S., Instructor in Drawing.
Mrs. Mary J. Carpenter, M.S., Librarian.
Louis Knapper, Florist.
Charles S. Crandall, B.S., Foreman of the Horticultural Department.
James Wiseman, Foreman of the Iron Shops and Engineer in Chief.
Hiram T. French, B.S., Assistant in Farm Experiments.
H. Campbell, Carpenter and Foreman of the Wood Shops.
Henry Munn, Foreman of the Farm.
Clarence P. Gillette, B.S., Assistant in Zoölogy.
Edward R. Lake, B.S., Assistant in Botany.
Philip B. Woodworth, B.S., Assistant in Chemistry.
Richard Hiscock, Engineer.

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* Resigned to accept the Presidency of the Dakota Agricultural College.

ACCOUNTS OF THE STATE AGRICULTURAL COLLEGE.

FOR THE NINE MONTHS ENDING JUNE 30, 1887.

SECRETARY'S ACCOUNT.

			Dr.	Cr.
October 1, 1886.	To cash on hand		$1,846 68	
“ “	To cash on deposit with College treasurer		7,636 89	
“ “	By balance due students on deposit accounts		----------	$1,327 49
June 30, 1887.	To special appropriation receipts as per Table No. 2:			
	From State Treasurer	$16,007 50		
	From Institution	275 44		
			16,282 94	
June 30, 1887.	By special appropriation disbursements		----------	12,641 09
“ “	To Current account receipts as per Table No. 3:			
	From State Treasurer	$19,761 06		
	From Institution	9,432 33		
			29,193 39	
June 30, 1887.	By current account disbursements		----------	33,202 47
“ “	To balance due students on deposit accounts		1,726 02	
“ “	By cash on hand		----------	1,484 32
“ “	By cash on deposit with College Treasurer less $38.98 June interest, and $1,382.54 outstanding warrants		----------	8,030 55
			$56,685 92	$56,685 92

The above statement may, perhaps, be more easily understood from the following:

TABLE NO. 1.—*Tabular Exhibit of Secretary's Account.*

Name of Account.	Balance Sheet, Oct. 1, 1886.		Transactions Oct. 1, 1886 to June 30, 1877.		Balance Sheet, June 30, 1887.	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Cash	$1,846 68			* $362 36	$1,484 32	
College treasurer	7,636 89		* $393 66		† 8,030 55	
Students' deposits		$1,327 49		* 398 53		1,726 02
Special appropriations		5,554 07	12,641 09	16,282 94		9,195 92
Current account		2,602 01	33,202 47	29,193 39	1,407 07	
Totals	$9,483 57	$9,483 57	$46,237 22	$46,237 22	$10,921 94	$10,921 94

* Balance of Dr. and Cr. transactions.

† Treasurer's statement is greater by $38.98 June interest not entered above, and by $1,382.54 June warrants still outstanding at close of month.

UMMARY OF TREASURER'S REPORT.

M. L. Coleman in Account with Agricultural College.

	Dr.	Cr.
To balance October 1, 1886	$7,636 89	
To receipts from State Treasurer and Secretary of State Board of Agriculture from October 1, 1886, to February 26, 1887	14,769 33	
To interest on deposits 5 months @ 3 per cent	104 59	
By warrants paid from October 1 to February 21, 1887		$22,510 81
	$22,510 81	$22,510 81

The above is a correct summary of my report to the State Board of Agriculture.

M. L. COLEMAN.

B. F. Davis in Account with Agricultural Colleeg.

	Dr.	Cr.
To receipts from State Treasurer and Secretary of State Board of Agriculture from February 26 to June 30, 1887	$30,925 16	
To interest on deposits 4 months @ 4 per cent	114 20	
By warrants paid from February 26 to June 30, 1887		$21,587 29
By balance on hand June 30, 1887		9,452 07
	$31,039 36	$31,039 36

The above is a correct summary of my report to the State Board of Agriculture.

B. F. DAVIS, *Treasurer.*

TABLE NO. 2.—*Statement of Special Appropriation Account for Nine Months, October 1, 1886, to June 30, 1887.*

Name of Appropriation.	Balance of Account, Oct. 1, 1886.		Receipts during nine Months.		Total Available.	Total Expended.	Balance of Account, June 30, 1887.		Total Appropriation for 1887-1888.	Balance of Appropriation in State Treasury June 30, 1887.
	Dr.	Cr.	From State Treasurer.	From Institution.			Dr.	Cr.		
Weather service instruments			$2,087 50		$2,087 50	$2,087 50			$2,087 50	
" " signals			200 00		200 00	170 22		$29 78	200 00	
" " telephone and telegraph			1,000 00		1,000 00	158 01		841 96	4,000 00	$3,000 00
" " incidental expenses			350 00		350 00	154 95		195 05	700 00	350 00
" " salary of assistant			400 00		400 00	311 10		88 90	1,600 00	1,200 00
Farm department, drainage & perm't imp'ts			400 00		400 00			400 00	800 00	400 00
" " bridge and approaches			500 00		500 00			500 00	1,000 00	500 00
" " hand implements			100 00		100 00			100 00	200 00	100 00
" " two-horse cultivator									35 00	35 00
" " two sets harness									50 00	50 00
" " two plows									30 00	30 00
" " lumber			100 00		100 00			100 00	200 00	100 00
" " furnishing farm house						3 75	$3 75		200 00	200 00
" " engine and boiler									500 00	500 00
" " class room apparatus						3 34	3 34		300 00	300 00
" " experimental work			500 00		500 00	75 00		425 00	500 00	
" " appropriation of 1885		$862 25			862 25	725 58		136 67		
" " ensilage & feeding exp'ts		195 64			195 64	195 64				
Horticultural department		34 23	600 00		634 23	193 63		440 60	1,000 00	400 00
" " culvert									250 00	250 00
" " barn									500 00	500 00
" " laboratory									5,000 00	5,000 00

Green house		76 38	170 00		246 38	134 13		112 25	340 00	170 00
" " painting and repairs						60 04	60 04		400 00	400 00
" " addition to dwelling									400 00	400 00
Mechanical department		450 00	1,000 00		1,450 00	926 96		523 04	4,000 00	3,000 00
" " addition to shops									3,000 00	3,000 00
Repairs of buildings		515 63	500 00		1,015 63	642 15		373 48	1,000 00	500 00
Steam works		146 85	1,000 00		1,146 85	499 35		647 50	4,500 00	3,500 00
Water works									2,000 00	2,000 00
Artesian well			1,000 00		1,000 00	787 42		212 58	1,000 00	
Mathematical and engineering department		66 96	300 00		366 96	45 50		321 46	600 00	300 00
Botanical department		388 95	400 00		788 95	582 86		206 09	800 00	400 00
Veterinary department		22 54	100 00		122 54	22 54		100 00	200 00	100 00
Chemical department		190 69	1,000 00		1,190 69	259 08		931 61	2,000 00	1,000 00
Zoölogical department		102 64	750 00		852 64	284 97		567 67	1,500 00	750 00
English department									100 00	100 00
Military department			250 00		250 00	19 70		230 30	500 00	250 00
Assembly hall	$244 44			$244 44						
Library		745 25	1,000 00	31 00	1,776 25	997 51		778 74	3,000 00	2,000 00
Farmers' Institutes		75 22	300 00		375 22	337 09		38 13	600 00	300 00
Fire escapes									500 00	500 00
Professor's barn									200 00	200 00
Dormitory									10,000 00	10,000 00
Apartment building									10,000 00	10,000 00
Student labor (see Table No. 5)		1,925 28	2,000 00		3,925 28	2,963 04		962 24	8,000 00	6,000 00
Forestry commission									1,000 00	1,000 00
Balances	5,554 07						9,195 92			
Totals	$5,798 51	$5,798 51	$16,007 50	$275 44	$21,837 01	$12,641 09	$9,263 05	$9,263 05	$74,792 50	$58,785 00

TABLE No. 3.—*Current Account, Oct. 1, 1886, to June 30, 1887.*

On Account of,	Dr. To Disbursements.	Cr. By Receipts.
Balance October 1, 1886		$2,602 01
State Treasurer, interest on proceeds of sales of U. S. land grant, see Table No. 11		19,761 06
Students' fees, two terms, less $167.20 credited to special appropriation accounts, see Table No. 4		3,856 56
Salaries, see Table No. 6	$22,379,61	166 66
Farm Department, see Table No. 7	4,263 05	3,815 63
Horticultural Department, see Table No. 8	887 45	413 00
Green-house Department	423 46	194 15
Apiary Department	12 57	24 37
Mechanical Department	922 00	59 37
Heating, lighting, cleaning and repairs	2,758 28	163 38
Academic Departments	772 96	1 75
Offices, postage, stationery, advertising and sundry	783 09	35 25
Fertilizer license fees		260 00
Donation from English student		149 85
State swamp land grant sale		198 20
Interest and exchange less $107.74 credited to special appropriation account		94 16
Balance June 30, 1887		1,407 07
Total	$33,202 47	$33,202 47

TABLE No. 4.—*Students' Fees, Two Terms.*

	Amount.
Room rent	$1,932 82
Incidental expense fee	1,226 25
Damages	6 90
Physiological dissection fee	18 00
Chemical analysis fee	560 79
Special examination fee less $30.50 credited to library special appropriation account	8 50
Matriculation fee, less $136.70, credited to Assembly Hall special appropriation account	103 30
Total, less $167.20 credited to other accounts as above	$3,856 56

TABLE NO. 5.—*Student Labor.—Account of Wages paid for 9 Months, Oct. 1, 1886, to June 30, 1887.*

	Amount.
Farm Department	$466 42
Horticultural Department	759 50
Green-house Department	223 00
Mechanical Department and repairs	308 18
Firing	86 28
Night-watch, bell ringing, choir, teaching, etc.	285 88
Janitor	364 21
Offices	87 80
Veterinary Department	17 44
Zoological Department	57 24
Botanical Department	81 37
Chemical Department	104 64
Military Department	40 48
Library	64 60
Total	$2,947 04

TABLE NO. 6.—*Salaries.*

	Amount.
President, dwelling and	$3,200 00
One Professor, dwelling and	2,000 00
One Professor	2,000 00
Seven Professors, dwelling and $1,800 each	12,600 00
One Professor	1,500 00
One Assistant Professor	1,300 00
One Assistant Professor, rooms and	1,200 00
One Assistant Professor	1,200 00
Two Instructors, rooms and $600 each	1,200 00
*Secretary, dwelling and	1,500 00
Assistant Secretary, room and	600 00
Librarian, room and	600 00
Foreman of Farm, dwelling, board, and	600 00
Foreman of Garden, rooms and	750 00
Foreman of Iron Shops, dwelling and	900 00
Foreman of Wood Shops, rooms and	600 00
Florist, dwelling and	750 00
§Engineer	500 00
§Assistant in Experiments, room and	600 00
§Assistants in Botany, Zoology, Chemistry, $500 each	1,500 00
Herdsman, dwelling and	450 00
§Fireman	360 00
Total	$35,910 00

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* $1,000 of this as Secretary of the Board of Agriculture from the State Treasury, the balance as Secretary of the College from the College funds.

§ Paid from special appropriations.

TABLE NO. 7.—*Account with Farm Department.*

On Account of,	Dr. To Disbursements.	Cr. By Receipts.
Labor and team	$924 83	$216 50
Farm house	542 00	21 60
Cattle	2,537 78	2,784 72
Sheep	13 00	487 05
Swine	18 44	208 75
Grain	18 15	3 10
Produce	23 05	93 91
Implements and repairs	59 03	
Wood	76 40	
Fertilizer	5 50	
Office, etc	44 87	
Balance		447 42
Footings	$4,263 05	$4,263 05

TABLE NO. 8.—*Account with Horticultural Department.*

On Account of,	Dr. To Disbursements.	Cr. By Receipts.
Labor	$159 36	
Team	102 68	
Grounds	152 48	
Vegetable garden	107 31	
Fruit garden	92 66	
Orchard	33 46	
Implements and repairs	68 55	
Ice	154 15	
Office, etc	16 80	
Sundry receipts		$413 00
Balance		474 45
Footings	$887 45	$887 45

TABLE NO. 9.—*Agricultural College Lands, United States Grant, Record of Sales and Forfeitures to the Present time.*

	Number of Acres sold at Original Sale.			Forfeited Lands Resold.			Total Sales.			Number of Acres Reverting by Forfeiture.	Aggregate of Sales, less Forfeitures to end of each Year. Acres.	Balance Remaining Vacant at end of each Year. Acres.
Year.	Acres.	Average Price Per Acre.	Amount.	Acres.	Average Price Per Acre.	Amount.	Acres.	Average Price Per Acre.	Amount.			
1867												235,682.46
1868	520.	$5 00	$2,600 00				520.	$5 00	$2,600 00		520.	235,162.46
1869	13,480.	3 19	43,000 00				13,480.	3 19	43,000 00		14,000.	221,682.46
1870	3,280.	3 44	11,280 00				3,280.	3 44	11,280 00		17,280.	218,402.46
1871	9,372.44	3 37	31,637 32				9,372.44	3 37	31,637 32		26,652.44	209,030.02
1872	20,580.25	3 19	65,660 75				20,580.25	3 19	65,660 75		47,232.69	188,449.77
1873	17,205.89	3 15	54,177 67	40.	$3 62	$145 00	17,245.89	3 15	54,322 67	40.	64,438.58	171,243.88
1874	2,039.95	3 20	6,519 75	40.	3 00	120 00	2,079.95	3 19	6,639 75	638.72	65,879.81	169,802.65
1875	4,798.99	3 08	14,796 97	40.	3 00	120 00	4,838.99	3 08	14,916 97	560.	70,158.80	165,523.66
1876	1,953.73	3 12	6,101 19	520.	4 38	2,280 00	2,473.73	3 39	8,381 19	1,758.40	70,874.13	164,808.33
1877	1,634.75	3 00	4,904 25	200.	3 00	600 00	1,834.75	3 00	5,504 25	1,438.06	71,270.82	164,411.64
1878	4,034.80	3 10	12,504 40	1,135.73	3 91	4,443 65	5,170.53	3 28	16,948 05	2,415 73	74,025.62	161,656.84
1879	6,782.12	3 02	20,506 36	1,318.06	3 08	4,054 18	8,100.18	3 03	24,560 54	1,978.11	80,147 69	155,534.77
1880	8,826.56	3 03	26,729 58	280.	3 18	890 00	9,106.56	3 03	27,619 58	4,926.33	84,327 92	151,354.54
1881	6,168.97	3 96	24,447 25	360.	4 33	1,560 00	6,528.97	3 98	26,007 25	1,987.19	88,869.70	146,812.76
1882	10,225.99	5 00	51,129 95	1,637.01	5 09	8,335 05	11,863.	5 01	59,464 90	760.11	99,972.59	135,709.87
1883	7,035 57	5 00	35,177 85	1,680.	5 03	8,448 00	8,715.57	5 00	43,625 85	560.	108,128.16	127,554.30
1884	1,846 01	5 09	9,390 05	526.45	5 38	2,832 25	2,372.46	5 15	12,222 30	200.	110,300.62	125,381.84
1885	704.88	5 74	4,044 40	119.52	5 67	677 60	824.40	5 73	4,722 00	525.47	110,599.55	125,082.91
1886	720.00	5 83	4,200 00	560.	5 78	3,240 00	1,280.60	5 81	7,440 00	440.	111,439.55	124,242.91
1887	1,718.27	6 45	11,091 35	320.	5 00	1,600 00	2,038.27	6 23	12,691 35	200.	113,277 82	122,404.64
Total	122,929.17	$3 58	$439,898 99	8,776.77	$4 48	$39,345 73	131,705.94	$3 64	$479,244 72	18,428.12		

TABLE No. 10.—*Agricultural College Trust Fund.*

Year.	Receipts of State Land Office on account of Principal for Agricultural College Lands sold.	Refunded on account of erroneous payments.	Balance transferred to credit of Agricultural College Trust Fund.	Aggregate to credit of Agricultural College Trust Fund at close of each fiscal year.
1868	$2,300 00	--------	$2,300 00	--------
1869	11,865 00	--------	11,865 00	$14,165 00
1870	5,895 00	--------	5,895 00	20,060 00
1871	20,101 53	--------	20,101 53	40,161 53
1872	33,621 93	$174 54	33,447 39	73,608 92
1873	29,583 47	--------	29,583 47	103,192 39
1874	4,686 75	--------	4,686 75	107,879 14
1875	5,399 24	--------	5,399 24	113,278 38
1876	5,939 30	390 00	5,549 30	118,827 68
1877	2,337 22	--------	2,337 22	121,164 90
1878	9,619 99	--------	9,619 99	130,784 89
1879	8,590 53	--------	8,590 53	139,375 42
1880	13,762 28	--------	13,762 28	153,137 70
1881	20,341 18	60 00	20,281 18	173,418 88
1882	51,449 27	--------	51,449 27	224,868 15
1883	34,482 28	825 90	33,656 38	258,524 53
1884	13,802 87	--------	13,802 87	272,327 40
1885	12,460 87	--------	12,460 87	284,788 27
1886	16,545 31	--------	16,545 31	301,333 58
1887	26,731 62	--------	26,731 62	328,065 20

NOTE.—Fifteen thousand dollars of the above fund was invested from 1870 to 1871 in War Bounty Bonds and held by the college.

TABLE No. 11.—*Agricultural College Interest Fund.*

Year.	Interest on Agricultural College Fund, at 7 per cent, paid by State Treasurer from Specific Tax Fund.	Interest from purchasers on balances due on certificates for part-paid land, less refundings and expenses for appraisals, etc.†	Receipts for penalty.	Trespass Collections.	Total accrued to credit of Agricultural College each year.	Amount paid over to Treasurer of Agricultural College.	Balance remaining to credit of Agricultural College Interest Fund at close of each fiscal year.
1869	--------	$56 68	$2 28	--------	$58 96	--------	--------
1870	*$874 95	1,789 56	56 42	--------	2,720 93	$2,279 89	--------
1871	§ 1,397 97	2,317 24	70 63	--------	3,785 84	2,976 00	$809 84
1872	3,953 17	3,099 51	122 97	--------	7,175 65	6,774 47	1,211 02
1873	6,040 33	4,907 77	110 96	--------	11,059 06	12,238 48	31 60
1874	7,407 65	6,499 21	155 12	--------	14,061 98	11,896 00	2,197 58
1875	7,717 24	6,552 93	125 97	$50 00	14,446 14	14,656 00	1,987 72
1876	8,124 31	6,692 47	306 64	1,706 75	16,830 17	18,817 89	--------
1877	8,396 64	5,726 58	189 64	860 00	15,172 86	15,172 86	--------
1878	8,740 62	6,405 26	247 21	414 00	15,807 09	13,320 61	2,486 48
1879	9,409 73	6,664 80	276 55	627 14	16,978 22	16,602 02	2,862 68
1880	10,240 28	7,333 23	148 73	115 00	17,837 24	17,799 15	2,900 77
1881	11,426 93	8,642 08	285 47	580 77	20,935 25	20,451 85	3,384 17
1882	13,957 04	8,345 45	204 96	--------	22,507 45	25,891 62	--------
1883	16,741 38	9,141 30	206 96	4,659 96	30,749 60	26,139 13	4,610 47
1884	18,739 02	8,881 98	237 56	51 16	27,909 72	27,402 94	5,117 25
1885	19,645 33	9,121 14	329 06	674 87	29,770 40	29,599 97	5,287 68
1886	20,571 65	9,323 98	565 41	--------	30,461 04	29,920 68	5,828 04
‡1887	16,493 98	7,577 57	309 84	229 98	24,611 37	19,761 06	10,678 35

---

* This amount was interest on war bounty bonds in which the fund was invested at the time.

§ $525 of this was interest on war bounty bonds in which the fund was invested part of the year.

† Refundings amounted to $352.27, ranging from nothing in 1880 and since to $145.21 in 1874. Appraisal expenses amounted to $1,045.13, ranging from nothing in 1872 to $208.94 in 1886. Advertising amounted to $688.39, ranging from nothing in 1870 to $218.35 in 1884. Trespass examination amounted to $4.00 in 1883.

‡ Nine months.

AGRICULTURAL COLLEGE LAND.

TABLE NO. 12.—*Showing, by Counties, the amount of Agricultural College Land sold at Original Sale for the nine months ending June 30, 1887.*

Counties.	Acres.	Price.	Amount.	Amount Paid.	Amount Due.
Alcona	87.60	$5 00	$438 00	$259 50	$178 50
Alcona	80.00	7 00	560 00	560 00	....
Alcona	40.00	8 00	320 00	320 00	....
Alcona	80.00	10 00	800 00	800 00	....
Cheboygan	40.00	5 00	200 00	50 00	150 00
Grand Traverse	40.00	10 00	400 00	400 00	....
Iosco	40.00	5 00	200 00	200 00	....
Manistee	160.00	10 00	1,600 00	1,600 00	....
Manistee	40.00	12 50	500 00	500 00	....
Montmorency	160.00	5 00	800 00	800 00	....
Oscoda	510.67	5 00	2,553 35	1,542 80	1,010 55
Oscoda	160.00	6 00	960 00	780 00	180 00
Presque Isle	40.00	7 00	280 00	70 00	210 00
Wexford	200.00	6 00	1,200 00	1,200 00	....
Wexford	40.00	7 00	280 00	70 00	210 00
Total	1,718.27	$6 45	$11,091 35	$9,152 30	$1,939 05

TABLE NO. 13.—*Showing, by Counties, the Amount of Forfeited Agricultural College Land sold for the nine months ending June 30, 1887.*

Counties.	Acres.	Price.	Amount.	Amount Paid.	Amount Due.
Cheboygan	80.00	$3 00	$240 00	$120 00	$120 00
Cheboygan	80.00	5 00	400 00	400 00	....
Gran Traverse	40.00	7 00	280 00	280 00	....
Manistee	40.00	5 00	200 00	200 00	....
Wexford	80.00	6 00	480 00	480 00	....
Total	320.00	$5 00	$1,600 00	$1,480 00	$120 00

TABLE NO. 14.—*Showing, by Counties, the Amount of Agricultural College Land Forfeited to the State during the nine Months ending June 30, 1887.*

Counties.	Acres.
Benzie	40.00
Cheboygan	40.00
Manistee	40.00
Wexford	80.00
Total	200.00

TABLE NO. 15.—*Showing, by Counties, the Amount of Agricultural College Land Vacant June 30, 1887.*

Counties.	Acres.
Alcona	21,713 07
Alpena	960 00
Antrim	3,120 93
Benzie	4,440 00
Charlevoix	3,605 09
Cheboygan	5,051 10
Grand Traverse	360 00
Iosco	26,794 97
Kalkaska	1,000 68
Manistee	5,960 00
Missaukee	799 64
Montmorency	7,444 30
Oscoda	14,090 12
Otsego	3,704 74
Presque Isle	360 00
Wexford	23,000 00
Total	122,404 64

SUMMARY OF INVENTORY, JUNE 30, 1887.

College farm and park, 676 acres @ $70		$47,320 00
Buildings—College hall	$15,000 00	
Williams hall	45,000 00	
Wells hall	25,000 00	
Library and museum building	25,000 00	
Chemical laboratory	18,000 00	
Botanical laboratory	6,000 00	
Mechanical laboratory	7,800 00	
Veterinary laboratory	5,400 00	
Armory and assembly hall	6,000 00	
Farm house	3,500 00	
Four brick houses @ $3,000	12,000 00	
Two brick houses @ $3,500	7,000 00	
President's and two frame houses	20,728 00	
One frame house	4,000 00	
Herdsman's house	600 00	
Ten barns at Professors' houses @ $250	2,500 00	
Horticultural barn and shed	1,100 00	
Cattle barn and shed	3,400 00	
Sheep barn	2,500 00	
Horse barn	3,000 00	
Piggery	2,000 00	
Brick work-shop	600 00	
Corn-house	500 00	
Green-house	9,500 00	
Feed barn	1,150 00	
Grain barn	1,600 00	
Tool-house	1,300 00	
Observatory	150 00	
Boiler-house and fixtures	5,000 00	
Bee-house	280 00	
		235,608 00
Water-works		4,690 00
Artesian well and connections		1,000 00
Steam works—		
Four boilers @ $600	$2,400 00	
Underground piping	2,700 00	
Pipes and fittings	495 53	
Tools for steam fitting	302 02	
		5,897 55
Ten fire extinguishers		400 00
Fuel on hand		300 00
Ice tools and pile-hammer		43 00
Farm Department—Cattle	$14,080 00	
Horses	1,150 00	
Sheep	805 00	
Swine	245 00	
Implements, produce, etc	6,014 62	
Horticultural Department—		22,294 62
Team, harness, etc	$295 50	
Tools	614 50	
Vegetable garden	236 75	
Office	29 85	
Compost and manure	60 00	
Miscellaneous	45 25	
Green-house—		1,281 85
Plants and implements	$6,370 70	
Furnaces	300 00	
Mechanical Department—		6,670 70
Tools in wood shop	$789 99	
Tools in iron shop	2,977 06	
Stock for repairs	210 50	
Physical apparatus	735 68	
		4,713 23
Footing carried forward		$330,218 95

INVENTORY.

Brought forward		$330,218 95
Chemical Department—Furniture and fixtures	$451 50	
Physical apparatus	6,501 50	
Chemical apparatus and chemicals	4,867 75	
		11,820 75
Mathematical and Engineering Department—		
Surveying instruments, etc.	$1,222 20	
Telescope, magic lantern and views	1,179 00	
		2,401 20
Botanical Department—Museum	$4,145 00	
Microscopes and other apparatus	1,961 32	
Furniture and fixtures	77 35	
		6,183 67
Library—Books and pamphlets	$18,550 00	
Furniture	1,295 50	
		19,845 50
General museum—Collections and cases		11,850 00
College Hall—Furniture		946 50
Williams Hall— Furniture		125 00
Secretary's office		396 00
President's office		223 00
Apiary—Bees, stock and apparatus		627 00
Armory—Furniture and military equipments		399 50
Flag-staff and flags		200 00
		$385,237 07

A SUMMARY OF THE RESOURCES OF THE MICHIGAN AGRICULTURAL COLLEGE.

Farm, buildings and equipments, as per above inventory	$385,237 07
Agricultural College trust fund, from sale of lands of United States grant	328,065 20
Balance due on purchase money " " " "	120,284 04
122,404.64 acres @ $5 per acre yet unsold " " "	612,023 20
880 acres @ $5 per acre yet unsold of swamp land grant	4,400 00
Total	$1,450,009 51

The present amonnt of the trust fund is taken from the last line (that for 1887) of the fifth column of table No. 10, page 15.

The balance due on purchase money is reported by the Commissioner of the State Land Office, and consists of the total amount for which the College lands have been sold up to the present time, *i. e.:*

The total of the tenth column in table No. 9, page 14	$479,244 72
Less the payments made on these sales, constituting the trust fund	328,065 20
	$151,179 52
And less balances unpaid on abandoned descriptions which have reverted to the State by forfeiture for non-payment of interest, as shown in column eleven of Table No. 9, page 14	30,895 48
	$120,284 04

The 122,404.64 acres yet vacant of the U. S. land grant are given in detail as located in the different counties in table No. 15, page 17.

The 880 acres of swamp land is what still remains unsold of a grant from the State to the College of swamp lands located in the townships of Lansing and Meridian in Ingham county, and Bath and De Witt in Clinton county.

TABLE NO. 16.—*Income of the Agricultural College from all sources, from the date of its foundation to the present time.*

Year.	From State Legislature.			Interest from United States Land Grant.	Total.
	Appropriations for Current Expenses.	Appropriations for Special Purposes.	Land Sales, Salt Spring and Swamp Land Grants.		
1855			$56,320 00		$56,320 00
1856					
1857	$40,000 00				40,000 00
1858					
1859	37,500 00				37,500 00
1860					
1861	6,500 00		152 25		6,652 25
1862	10,000 00		218 97		10,218 97
1863	9,000 00		407 80		9,407 80
1864	9,000 00		726 09		9,726 09
1865	15,000 00		1,156 61		16,156 61
1866	15,000 00		1,094 27		16,094 27
1867	20,000 00		7,608 38		27,608 38
1868	20,000 00		592 49		20,592 49
1869	20,000 00	$30,000 00	17,559 00	$58 96	67,617 96
1870	20,000 00		1,320 02	2,720 93	24,040 95
1871	18,250 00	10,500 00	4,135 72	3,785 84	36,671 56
1872	18,250 00	3,000 00	217 05	7,175 65	28,642 70
1873	21,796 00	15,602 00	10 13	11,059 06	48,467 19
1874	13,000 00	15,602 00	150 13	14,061 98	42,814 11
1875	7,638 00	7,755 50	144 53	14,446 14	29,984 17
1876	7,638 00	6,755 50	1,773 09	16,830 17	32,996 76
1877	6,150 00	30,686 80	979 06	15,172 86	52,988 72
1878	6,150 00	5,686 80	826 60	15 807 09	28,470 49
1879	4,971 80	16,068 32	712 22	16,978 22	38,730 56
1880	4,971 80	7,068 32	797 55	17,837 24	30,674 91
1881	7,249 00	43,720 50	461 95	20,935 25	72,366 70
1882	7,249 00	8,945 50	358 46	22,507 45	39,060 41
1883	8,385 00	23,793 00	391 95	30,749 60	63,319 55
1884	8,385 00	10,526 00	1,259 90	27,909 72	48,080 62
1885		35,103 00	187 50	29,770 40	65,060 90
1886		22,617 00		29,920 68	52,537 68
1887		* 44,040 00	† 198 20	† 19,761 06	63,999 26
Total	$362,083 60	$337,470 24	$99,759 92	$317,488 30	$1,116,802 06

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* Including appropriations of $5,437.50 for weather service and $1,000.00 for forestry commission.
† Oct. 1, 1886, to June 30, 1887, nine months.

BOUNTY ON MANUFACTURE OF SUGAR.

In December, 1886, Mr. Daniel Root, of Hudson, Mich., submitted the following statement of the amount and process of manufacture of sugar from sorghum cane:—

"In the spring of 1885 I planted thirty-five acres to amber cane. It was planted and tilled in the same manner as corn. By the 20th of September, at which time the cane was cut, it was not well matured, owing to the backward season. The canes with the leaves on were passed between rollers in the ordinary way. Before putting the juice into the evaporating pan it was treated with milk of lime to neutralize its natural acid. The juice was then brought to a boil and skimmed, and after standing ten or fifteen minutes to settle was drawn into the evaporating pan. Here sulphurous acid was added to neutralize any possible excess of lime. If the juice was intended for syrup it was boiled till it reached a temperature of 228° Fah., and if for sugar to 234° Fah.

"I manufactured 5,000 gallons of syrup. During the winter much of this syrup crystallized, and the following summer the melada or candied portion of the syrup was separated in a centrifugal machine and yielded 10,875 pounds of sugar; this, together with what we made the previous fall, made a total of 12,135 pounds of sugar like that sent to you for analysis.

"DANIEL ROOT."

Mr. Root's affidavit to the above statement and the certificate of Dr. R. C. Kedzie that the sample of sugar sent for testing contained 97 per cent of crystallizable sugar are both on file in this office. By resolution of the State Board of Agriculture Mr. Root was declared entitled to bounty as provided by the following enactment:—

AN ACT TO ENCOURAGE THE MANUFACTURE OF SUGAR.

1881, Act 268.

SECTION 1. *The People of the State of Michigan enact*, That all companies or corporations formed or that may be formed for the purpose of cultivating and growing sugar cane, cornstalks or beets and the manufacturing of sugar from the same, and any and all individuals engaged or that may be engaged in such culture and manufacture shall be entitled and subject to the provisions of this act.

SEC. 2. All buildings or machinery used for the purpose mentioned in section one of this act shall be exempt from taxation, for the term of five years, from the first day of January, eighteen hundred and eighty-two.

SEC. 3. The State board of agriculture shall direct their secretary to receive reports of results, and said secretary shall collect such reports, and the process by which such results are obtained in the culture of sugar cane, cornstalks and beets and the manufacturing of sugar from the same, and report the same in full to the board, and said board shall incorporate the same in their annual report.

SEC. 4. There shall be paid from the treasury of the State, as bounty to any individual, company or corporation, upon the report and determination of the board of agriculture, as provided for in section three, the sum of two dollars for each and every hundred pounds of merchantable sucrose sugar manufactured by said individual, company or corporation in this State from sugar cane, cornstalks or beets grown therein, and said bounty shall be paid upon each year's results for the term of five years from the first day of January, eighteen hundred and eighty-two, to all individuals, corporations or companies entitled to the same under the provisions of this act: *Provided*, That the person receiving such bounty shall make a report to the State board of agriculture, duly verified, of all the parts of the process employed in the manufacture of such sugar, together with a definite statement of the yield: *And provided further,* That it shall contain at least 80 per cent crystallized sugar, as determined by the polariscope, under the direction of the State board of agriculture.

The period covered by the above act has now expired. Since its enactment Mr. Root of Hudson has been the only person who has made application for the bounty thus offered by the State. During the past five years he has applied for and received bounty as follows:

Year.	Lbs.	Bounty.
1882	2,100	$42 00
1884	,000	120 00
1886	12,135	242 70

The following letters from Mr. Root will be of interest:

HUDSON, MICH., October 26, 1887.

Henry G. Reynolds, Agricultural College, Mich.:

DEAR SIR,—Yours of the 22d at hand. I shall continue to make sorghum sugar more or less, and it will pay without the bounty when we have a good season for cane or corn—especially so when we use the new process of washing out the sweet instead of rolling it out of the cane. By the new process we get all, or nearly all, of the sweet there is in the cane, whereas the best roller mills only get one-third.

Yours truly,
DANIEL ROOT.

HUDSON, MICH., November 10, 1887.

Secretary H. G. Reynolds, Agricultural College, Mich.:

DEAR SIR,—In reply to yours of 28th ult.: A good corn season is a good cane season. We have never made any sugar from corn stalks. The juice of the corn stalks, when the ears are in the dough stage, or just before the kernels harden, is nearly or quite as sweet as that of amber cane, but it will not yield as many gallons per acre. Some varieties of corn are more juicy and sweeter than others.

When we get our diffusion plant in operation I will give you a full description of it. It will be on a smaller scale than the one used this year with such good results, at Fort Scott, Kansas.

The process of diffusion is to slice the cane into thin chips, then run these chips into a battery of ten or a dozen cells, each of which holds about one ton. The cells are filled at the top, and, when the sweet is all extracted, discharged at the bottom. The cells can be closed water tight, and are connected with pipes to run warm water in at the top and out at the bottom, and thence into the top of the next cell, and so on through the battery. Upon issuing from the last cell the water contains nearly as great a proportion of sweet as does the juice from a roller mill, and it is then run into tanks for defecation.

When a cell has all the sweet washed out, it is disconnected from the rest of the system, the water forced out of it by compressed air, and the chips discharged. It is then refilled and again connected with the next cell. The pipes are fitted with valves, so that the water runs on through the remaining cells when one is disconnected for discharging and refilling.

A battery having a capacity for 150 to 200 tons of cane per day would cost, with the slicing machinery, about $10,000. Of course a smaller battery would cost less.

Yours truly,

DANIEL ROOT.

The last report of the United States Department of Agriculture, that for 1886, has, on pages 302 to 341, an account of the government experiments in the manufacture of sorghum sugar, at Fort Scott, Kansas. Any one interested in the subject can obtain a copy by applying to the member of Congress from his district.

In the body of this volume will be found a reprint of an article on this subject, by Dr. H. W. Wiley, the chemist of the United States Department of Agriculture, taken from the proceedings of the Society for the Promotion of Agricultural Science for 1887.

DEPARTMENT REPORTS.

REPORT OF PRESIDENT WILLITS.

To the Honorable State Board of Agriculture:

I have the honor to submit my third report. My first was from July 1, 1885, the date of my assumption of duties at this college, to September 30, the end of that fiscal year. My second was for the full fiscal year 1885–6; and this, in consequence of a change by law of the fiscal year, will cover the time from September 30, 1886, to June 30, 1887.

Since my last report there has been but little change to chronicle. The work on the farm and garden and in the class-rooms and laboratories has been eminently successful. The total attendance for the year numbered 323. The dormitories were crowded, with three in a room in all cases where personal affiliations and the size of the room would permit, and some new rooms were extemporized in the other buildings on the grounds. The students have been patient, hoping for better accommodations as soon as the new dormitory shall be completed.

The buildings are all in good repair, the dormitories in a decidedly improved condition. A new hard wood floor has been laid in the two upper stories of Williams Hall, and the corridors of both halls have been calcimined and the wood work painted, so that the general appearance of the halls is brighter and neater. I wish to note the fact that the students have so far appreciated the improvement of their quarters as to take much better care of them. During the year there has been no reckless damage done, and the ordinary wear and tear has been reduced to a minimum. In my weekly inspection of the buildings I have found but two pencil marks on the walls. When it is considered that at no time has there been less than 120 students in one, or 130 in the other, dormitory, the foregoing record is sufficient testimony of the good order of the students. What is true in the dormitories is true on the grounds and in the other buildings. Not a single case of injury to property has occurred, nor a single "mad prank" to annoy the executive. The voluntary attendance at the daily chapel exercises has so far increased as to sometimes test the capacity of the chapel, and the attendance on the Sunday Bible classes and the meetings of the Young Men's Christian Association has been satisfactory. The going to the city has become less frequent, being on the average considerably less than once a week, and the relations of the students with the police officers have so far improved that there is no conflict or trouble of any kind. In other words, the general demeanor of the students has been that of gentlemen.

The old physical laboratory in the corridor of old College Hall has been removed, so that by opening the slide doors the whole corridor can be used with the chapel, thereby adding to the latter an increased capacity of one-third for public exercises, and largely facilitating the daily college work. Hydrants have been placed at all sewers adjacent to the dormitories and out-houses, so that the daily slops of the students' and club rooms are constantly flushed away. A student is detailed to each dormitory whose daily duty it is to pick up and rake away all refuse matter that might accumulate in the vicinity, and to sweep out the outhouses, and once a week to mop the latter. The result is that at no time is there an accumulation of decaying or offensive matter to breed disease or annoy the senses.

THE HEALTH OF THE COLLEGE.

I speak of these facts only for the reason that since my last report the college has been afflicted with a malarial fever that showed some typhoid characteristics, and I desire to place on record the fact that in no degree can it be charged to the want of the ordinary sanitary precautions for which the college authorities may reasonably be held responsible. The illness above noted took us by surprise, as the college had been distinguished for its healthy location. It was manifest that there was some cause for this sudden affliction. While it was true that the illness was not more prevalent than in the villages and cities of the State, still our location was such that we felt that it should be less. An investigation soon demonstrated in a measure the cause. The water for drinking and domestic purposes was obtained only from surface wells, and what with the long months of dry weather and the large increase of students and other people connected with the college, they ran low, and several became dry. This state of things was aggravated by the exceptional number of picnic parties which during the season had occupied the grounds, some numbering as high as 200, who kept the only remaining well in lively use all day. The result was that when night came the water was low and turbid, and the students went thirty rods with their pitchers to a well which had always been pure, and was not in such constant use. This well was found unhealthy, and was at once dismantled. During the year two of our students died, one from the fever and the other from other causes. All the remainder got well, and most of them reported last spring in good health and spirits. But the experience was a grave one, and the situation a source of great anxiety. It was manifest that the water supply was not wholesome and was entirely inadequate to the increasing demand, and that nothing short of

AN ARTESIAN WELL AND WATER-WORKS

would place us beyond a danger that no care, however constant and earnest, could wholly obviate. It might be years again before a like concurrence of causes would bring to us like results, but the fact that we were liable to them at any time was a source of solicitude. An appeal was made to the Legislature last winter, and that body without hesitation gave us $1,000 for an artesian well and $2,000 to extend the water-works. The well has been bored and at the depth of 343 feet an abundant supply of wholesome water was obtained, pronounced such by the chemical department after repeated analyses, ofa constant temperature of 50½ degrees, and which flows at the surface. The bore is a six inch one, and the well has been piped 90 feet to the rock, so that there is no possibility of being affected by surface water. Our largest pump has been tried and the supply is adequate for fire purposes without a tank. We feel, therefore, no apprehension for the future supply of good water for the largest demands, and that the future health of the institution is assured.

ADDITIONAL HELP IN THE DEPARTMENTS.

With the increase of students it soon became manifest that additional assistance was necessary. In the several departments the following were employed: In English, Prof. H. R. Pattengill, for many years principal and instructor in the public schools of the State, and editor and proprietor of the "School Moderator," has proved himself an acquisition to our corps of instructors; in Mathematics, Joseph B. Cotton; in Botany, Edward R. Lake; in Entomology, etc., Clarence P. Gillette; in Agriculture, Hiram T. French; in Chemistry, Philip B. Woodworth; and in Drawing, Will S. Holdsworth; the last six all graduates of our college, and all in their repective specialties, young men of zeal and promise. Their work has been eminently satisfactory.

Since the establishment of the Mechanical Department, Mr. Wiseman, who was simply an engineer before that, became in addition foreman of the iron shop, and Mr. Hiscock, who was fireman, has become engineer, and another man as fireman has been employed. Mr. Mohn, for many years college carpenter, became in addition foreman of the wood shop. Mr. Mohn resigned last winter, and Mr. H. Campbell, for some time engaged in the Pullman shops at Detroit, was employed to take his place. As instructors in the shop, both Mr. Wiseman and Mr. Campbell (as did Mr. Mohn) have done extremely well, proving themselves patient and efficient. The qualities required in their respective positions must necessarily be of a higher grade than that of a mechanic merely, and they ought to command a salary commensurate with the duties imposed upon them. Mr. Wiseman's claims have, in a manner, been recognized, but Mr. Campbell still awaits his advance, which it is hoped the board will soon find the means to give.

Other assistance has been rendered in special classes by students in the senior class, and I ought not to fail to note the very efficient services of Henry W. Baird, the assistant secretary, who taught book-keeping. He did his work with such acceptance that it is to be hoped that he may be permanently assigned to that branch.

Professor Lewis McLouth, since my last report, has been tendered and has accepted the presidency of the Dakota Agricultural college. He resigned his position here May 15, last, and at once entered upon his new duties. His loss will be felt in the State. From his long connection with its educational interests he was widely known, and wherever known he was respected for his abilities. It was a matter of great regret that we consented to let him go. His zeal for the new department of Mechanic Arts was so strong that great expectations were based upon his labors and influence in its behalf.

The question of a successor to Prof. McLouth has been happily solved by the appointment of Lieut. William F. Durand, of the United States navy, a graduate of the Naval Academy, who has resigned to accept this position.

The course at the Naval Academy is so nearly, in many of its features, like that of our mechanical course, as I found when I visited the institution two years ago, that Prof. Durand will come to us with the skill and acquirements necessary to build up the department. Moreover, he comes to us after three years' detail under United States statute to mechanical institutions, and comes directly from Worcester Institute, one of the most renowned in the country. He has therefore had the experience in teaching which is essential to success as an instructor.

THE APPROPRIATIONS.

The Legislature gave us $10,000 for a new dormitory for about sixty students, and $10,000 for an apartment building or buildings for the assistant professors and instructors and their families, and for the military instructor and the Signal Service officer. As the present dormitories are to a considerable extent occupied by these instructors, the rooms vacated by them, with the new dormitory, will enable us to accommodate from seventy-five to one hundred more students, so that we can catalogue four hundred. From present appearances both buildings will be fully occupied as soon as constructed. We were given $5,000 for a horticultural laboratory, which will enable us to construct one of the finest and best appointed in the United States. This will place that department on a basis commensurate with the standing of this college, and with the importance of fruit culture in this State. We were given $3,000 for an extension of the shops, and $1,500 for two new boilers, both rendered necessary to fully equip the Mechanical department. This will enable us, by giving us shop room, systematically to assign for stated periods when other work cannot be done, the students in the agricultural course to shop work, a demand that I referred to in my last report. This will fill out the time of required manual labor which is the distinguishing feature of this college, by utilizing in the shop the seasons of the year when work cannot be done on the farm or garden or grounds.

Thus it will be seen that in the last four years there have been placed on an independent basis the Veterinary, Mechanical, Military and Horticultural departments, all with their laboratories, shops and drill hall; and this completes the round of development necessary to equip all the departments required by the land grant act of 1862. I need only to add that the college now stands in its equipment and *morale*, without a superior of its kind in the United States, recognized as such at home and abroad.

But institutions should never stand still; like individuals, when they cease to grow there soon appear elements of decay. With added years come new demands, and to keep abreast of the age every college must be alive to the new want. When first founded agricultural colleges were essentially educational. The land grant of 1862 was primarily for educational purposes. The importance of experimental work was but incidentally recognized. As years passed the importance of this work became more apparent, and efforts in that line were made, but being subject to the leading purpose of the college, the educational, the efforts were sporadic and unsatisfactory. It was found, moreover, that experiments were costly, and the funds could not be spared from the current expenses of the college already stocked for educational work. Recognizing these facts, it was determined to appeal to Congress to supplement the endowment of 1862, whose leading purpose, as before stated, was instruction, by an annual appropriation of $15,000 for each college which should be exclusively devoted to experiments in agriculture and cognate sciences. Efforts had been made in the Forty-eighth Congress, but they failed. It was not till the Forty-ninth Congress that a systematic and successful movement was made. July 8, 1885, a convention of all the agricultural colleges in the United States was held in Washington and a united effort was initiated to present the matter to the Forty-ninth Congress, to assemble the following December. Being on the committee appointed by that convention, I spent seven weeks in Washington in December and January, 1885–6, and ten days last winter. The first session the bill, as we matured it, was gotten through the committees of both houses, and there it remained for the second session. The chances were slim for its passage amid the overwhelming mass of unfinished legislation and the conflicting interests incident to the wants of a great country. But by dint of hard work it passed the Senate in a mutilated form and went to the House of Representatives, where, near the close of the session, under suspension of the rules, and therefore without chance for amendment, it passed by an overwhelming vote and went to the President, who signed it March 2, 1887.

The following is a copy of the act as passed:

THE HATCH BILL.

[Full text of the Experiment Station Bill as enacted by Congress and approved by the President.]

AN ACT to establish agricultural experiment stations in connection with the colleges established in the several States under the provisions of an act approved July second, eighteen hundred and sixty-two, and of the acts supplementary thereto.

SECTION 1. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established, under direction of the college or colleges, or agricultural department of colleges, in each State or territory established, or which may hereafter be established in accordance with the provisions of an act approved July second, eighteen hundred and sixty-two, entitled "An act donating public lands to the several States and territories which may provide colleges for the benefit of agriculture and the mechanic arts," or any of the supplements to said act, a department to be known and designated as an "agricultural experiment station:" *Provided*, That in any State or territory in which two such colleges have been or may be so established, the appropriation hereinafter made to such State or territory shall be equally divided between such colleges, unless the Legislature of such State or territory shall otherwise direct.

SEC. 2. That it shall be the object and duty of said experiment stations to conduct original researches or verify the experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or territories.

SEC. 3. That in order to secure, as far as practicable, uniformity of methods and results in the work of said stations it shall be the duty of the United States commissioner of agriculture to furnish forms, as far as practicable, for the tabulation of results of investigation or experiments; to indicate, from time to time, such lines of inquiry as to him shall seem most important; and in general, to furnish such advice and assistance as will best promote the purposes of this act. It shall be the duty of each of said stations annually, on or before the first day of February, to make to the Governor of the State or territory in which it is located, a full and detailed report of its operations, including a statement of receipts and expenditures, a copy of which report shall be sent to each of said stations, to the said commissioner of agriculture, and to the secretary of the treasury of the United States.

SEC. 4. That bulletins or reports of progress shall be published at said stations at least once in three months, one copy of which shall be sent to each newspaper in the States and territories in which they are respectively located, and to such individuals actually engaged in farming as may request the same, and as far as the means of the station will permit. Such bulletins or reports, and the annual reports of said stations, shall be transmitted in the mails of the United States free of charge for postage, under such regulations as the postmaster general may from time to time prescribe.

SEC. 5. That for the purpose of paying the necessary expenses of conducting investigations and experiments, and printing and distributing the results as hereinbefore prescribed, the sum of $15,000 is hereby appropriated to each State to be specially provided for by Congress in the appropriations from year to year, and to each territory entitled under the provisions of section eight of this act, out of any money in the treasury proceeding from the sales of public lands, to be paid in equal quarterly payments on the first day of January, April, July and October in each year, to the treasurer or other officer duly appointed by the governing boards of said colleges to receive the same, the first payment to be made on the first day of October, 1887: *Provided, however*, That out of the first annual appropriation so received by any station an amount not exceeding one-fifth may be expended in the erection, enlargement or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding five per centum of such annual appropriation may be so expended.

SEC. 6. That whenever it shall appear to the secretary of the treasury from the annual statement of receipts and expenditures of any of said stations, that a portion of the preceding annual appropriation remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

SEC. 7. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States or territories in which they are respectively located.

SEC. 8. That in States having colleges entitled under this section to the benefits of this act, and having also agricultural experiment stations established by law separate from said colleges, such States shall be authorized to apply such benefits to experiments at stations so established by such States; and in case any State shall have established, under the provisions of said act of July second, aforesaid, an agricultural department or experimental station in connection with any university, college or institution not distinctively an agricultural college or school, and such State shall have established, or shall hereafter establish a separate agricultural college or school, which shall have connected therewith an experimental farm or station, the Legislature of such State may apply in whole or in part the appropriation by this act made to such separate agricultural college or school; and no Legislature shall, by contract express or implied, disable itself from so doing.

SEC. 9. That the grants of moneys authorized by this act are made subject to the Legislative assent of the several States and territories to the purpose of said grants: *Provided*, That payments of such installments of the appropriation herein made as shall become due to any State before the adjournment of the regular session of its legislature meeting next after the passage of this act shall be made upon the assent of the Governor thereof duly certified to the secretary of the treasury.

SEC. 10. Nothing in this act shall be held or construed as binding the United States to continue any payments from the treasury to any or all the States or institutions mentioned in this act, but Congress may at any time amend, suspend or repeal any or all of the provisions of this act.

The bill as originally drafted by the committee, and which was called the Hatch bill for the reason that Mr. Hatch was the very efficient chairman of the committee on agriculture in the House, carried the annual appropriation in the bill itself. But in the three days' discussion in the Senate the whole bill was sadly mutilated, not from intent, but from a desire to harmonize sundry conflicting demands. Among other things, it was thought best that this law should be no exception to the general rule, which is that all expenditures shall be specifically appropriated annually by Congress; hence the words "to be specially provided for by Congress in the appropriations from year to year" were inserted in the fifth section. By accident the word "hereafter" was not incorporated in the amendment. It was supposed that the specific appropriation made in the preceding words would carry the appropro-tions for the first year, and the intent was that only hereafter should the amount be in the regular appropriation bill. Mr. Hatch did not discover the error in the haste of the closing session (I was not present, the college then being in session), and the omission was not noticed till after Congress adjourned. The comptroller of the treasury holds that the money is not appropriated. But the law is the law of the land, and under it we have the claim for the $15,000 a year as completely as any United States official for his salary. The matter will need looking after, however, and it is to be hoped that we shall not only at the next session of Congress obtain the appropriation for next year, but as a deficiency for this year. We shall know by the opening of the next spring what the fate of this year's appropriation may be in time for the initiation of the work.

This act, if rendered efficient by the requisite appropriations, opens up a wide field of usefulness for the college, which should be maturely considered and systematically entered upon. The second section of the act gives the scope of the experiments. The details of a plan for the work will in due time be presented to you for your consideration. All the heads of departments of the college relating to agriculture are studying the subject and will in the plan submit suggestions.

Before concluding, I feel that I ought to add a few words in commending the very valuable services of our secretary, Henry G. Reynolds. The wisdom of his appointment has been demonstrated. A thorough book-keeper, he has kept all the complicated accounts and the different funds in such a state of daily accuracy as to show at any moment their true standing. As our purchasing agent he has been conservative, economical and firm in his administration. Being a graduate of the college, he knows thoroughly all its wants, and has been of great assistance to us all, and to me especially. He is popular with the students and with the alumni. He is a hard worker, and keeps well in hand all the details of the business part of the institution. With him standing guard over the finances, we need not fear the closest scrutiny at any moment.

In conclusion I have only to add my gratitude for the continued hearty support of the board and the faculty.

EDWIN WILLITS.

June 30, 1887.

REPORT OF THE PROFESSOR OF AGRICULTURE AND SUPERINTENDENT OF THE FARM.

To the President of the College:

Dear Sir,—I herewith submit my report of the work of the Agricultural Department for the nine months ending June 30, 1887:

INSTRUCTION.

The whole number who have received instruction in Practical Agriculture during the time covered by this report is as follows: Freshmen, 71; Sophomores, 60.

INSTITUTES.

I was assigned to Three Oaks and Fremont Center in the arranging of the State Institutes, and at the request of the local committees I attended the Howell Institute, the Short Horn Breeders' meeting in Jackson, the annual meetings of the State Associations of Holstein and Short Horn Breeders and the Dairymen's Convention at Flint, and presented papers at all of these meetings.

I attended the National Fat Stock Show held in Chicago in November, and was delegated to attend the meeting of the Consolidated Cattle Growers' Association held at the same date.

THE TEACHERS OF AGRICULTURE.

This association met at Champaign, Ills. There was a fair attendance and a pleasant meeting. The next meeting will be held at Columbia, Mo.

DONATIONS.

Donations are acknowledged from the following persons and firms:

Albion spring-tooth cultivator and broadcast seeder, from the Albion Manufacturing Company, Albion, Mich.; potato furrower and cultivator, from C. L. Davis, Filer City, Mich.; one barrel extra fine dairy salt, from C. F. Moore, St. Clair, Mich.; one bag dairy salt, from Genesee Salt Company; Vol. 2 American Shropshire Record, from Mortimer Levering, Lafayette, Ind.

PERMANENT IMPROVEMENTS.

Among the permanent improvements authorized by the Board of Agriculture may be mentioned a new double silo, to be located on the north side of the cattle barn, with a capacity of 150 tons. There is to be a six-feet basement wall, with opening into the feed room on a level with the stable. On this wall a frame will be placed, using 2x12 joists, 16 feet long, for studding. These will be covered with inch boards—first thickness placed horizontally and the second up and down, with tarred paper between.

Our ensilage from the experimental silo used last winter and spring was the best we have ever had; and all we have said of its value as a stock food, in combination with other foods, is confirmed by every additional year of trial. We built our first silo in 1881, and those interested will find in our annual reports our conclusions as to the value of this system of preserving fodder.

Another permanent and much needed improvement will be the replacing of the old bridge over the Cedar river (which we have considered unsafe for two years past) with a low truss iron bridge.

EXPERIMENTS.

We have continued the experiment of feeding steers of different breeds, a full report of which will be found in Bulletin No. 24, published in this volume.

On account of the change of time for making the annual report from September 30 to June 30, a report of the field experiments is necessarily deferred.

As to our future plans for farm experiments, it seems to me wise to continue for some years the feeding experiments with cattle, and I respectfully recommend that measures be adopted to secure specimens of different breeds of sheep and swine, as well as of cattle for such experimental feeding.

The dairy interests are coming to be more and more prominent in our State. Their importance is generally conceded, and I recommend that in planning our experimental work for the coming year, they receive a fair share of attention.

The growing of a sufficient acreage of some of the grasses and clovers that have not been tested here in actual feeding, to make such a trial possible, is also suggested, as well as the testing of a mixture of grasses and clovers for permanent pasture, to compare with those we now have that have never been plowed, but are covered with a thick sward of June grass and white clover.

This question of the value of permanent pastures is an importan one, especially to us, as we have from sixty to eighty acres that annually yield a large amount of nutritious grasses; but the surface is uneven, and the question has been shall we plow, cultivate and level, and make the field more inviting to the eye, but at the expense for years of the yield and quality of its grass product.

I have submitted this question to quite a number of our leading farmers, and their advice, almost without exception, has been in favor of retaining the old permanent sward.

Grass is coming to be of more and more importance in our agriculture, and the testing of new sorts to determine their adaptability to our soil and climate, and their value in the production of beef and dairy products, is work in the right direction, and must eventually result in greatly increasing the carrying capacity of our fields.

THE THIRD ANNUAL SALE OF CATTLE

was held on March 23. The weather was propitious, the attendance large, embracing many of our leading breeders, and the bidding spirited, especially on some of the younger animals. The average prices realized were fully up to our expectations, and the kindly feeling of the cattle men present attested to their interest in and appreciation of the efforts made to develop and improve the college herds. There is, I think, no doubt in the minds of the members of the Board of Agriculture of the success of these sales, not alone in disposing of the surplus stock, but also in attracting the attention of many of the citizens of our State who would not be likely to know much of us if not called here by a public occasion of this sort. They come to the cattle sale, they see the college and learn something of its educational work, its aims and what it purports to be. We must use every means to enlist the attention and the hearty support of the farmers in this college which was organized and is to live and prosper only as it is true to their interests in tangible and intelligent forms. The following is a list of the animals sold, purchasers and prices paid:—

Purchaser.	Post-office Address.	Name of Animal.	Price.
SHORT HORNS:			
William Steele	Ionia, Mich	Susie Bates	$170 00
William Steele	Ionia, Mich	College Susie 2d	80 00
S. S. Olds	Lansing, Mich	College Phœnix 2d	70 00
Amos Wood	Mason, Mich	College Phœnix 3d	70 00
S. O. Bush	Battle Creek, Mich	College Derwent 2d	100 00
A. McNorton	Port Huron, Mich	College Acomb 2d	130 00
C. R. Palmer	Napoleon, Mich	Hamlet 8th	55 00
Geo. B. Clark	Vernon, Mich	College Airdrie 2d	75 00
James Turner	Lansing, Mich	Victoria Duchess 4th	155 00
S. R. Crittendon	Saline, Mich	Col. Page 4th	40 00
A. Sherwood	Three Oaks, Mich	Hebe 2d	75 00
James Turner	Lansing, Mich	Jennie Baldwin	170 00
A. Sherwood	Three Oaks, Mich	Boulanger	80 00
J. Shultz	Lansing, Mich	Baron of Turlington 5th	100 00
A. Harlow	Watertown, Mich	Roan Acomb 2d	105 00
Isaac Barwise	Rochester, Mich	Sir Dennis	90 00
William Steele	Ionia, Mich	College Duchess 2d	255 00
James Turner	Lansing, Mich	Coll. Vict. Duchess 4th	150 00
James Turner	Lansing, Mich	College Rose 2d	125 00
J. Shultz	Lansing, Mich	R'n Duch. of Crow Farm 2d	200 00
A. Sherwood	Three Oaks, Mich	Hela 8th	85 00
A. Sherwood	Three Oaks, Mich	Hela	90 00
W. J. Barto	Saginaw, Mich	Di Vernon	105 00
Geo. B. Clark	Vernon, Mich	Heroine 7th	55 00
William Steele	Ionia, Mich	Coll. Peri Duchess 4th	300 00
Prof. A. J. Cook	Agricultural College	College Derwent	250 00
		Total	$3,180 00
		Average	122 30
HEREFORDS:			
William Steele	Ionia, Mich	College Horace	$115 00
Sotham & Stickney	Pontiac, Mich	Argyle	100 00
William Steele	Ionia, Mich	Dove 3d	200 00
William Steele	Ionia, Mich	Dove 2d	225 00
Sotham & Stickney	Pontiac, Mich	College Grove	50 00
		Total	$680 00
		Average	136 00
HOLSTEIN:			
S. Miller	Lansing, Mich	College Tecumseh	$50 00
		Total of sale	$3,910 00
		Total average	122 19

PURCHASE OF STOCK.

The Board of Agriculture, at the meeting held in connection with the cattle sale, authorized President Wells and myself to attend the public sale of Short Horns from the celebrated Woodburn herd, owned by A. J. Alexander, Lexington, Kentucky, and purchase a few animals at our discretion. To my great regret President Wells was detained by business, and I made the trip without him. I was fortunate in having the company of some of our Michigan breeders, who attended the sale and purchased a number of the best animals, among them Messrs. Jas. M. Turner of Lansing, Dwight Curtis of Hillsdale and J. S. Flint, as the representative of Wm. Steele of Ionia. The trip, while a hurried one and marred somewhat by disagreeable weather, was still, in many respects, a pleasant one. Kentucky is historic ground to every lover of good Short Horns, and it was very pleasant to meet some of the breeders famous in Short Horn annals on their own ground. The Woodburn farm is a grand estate, and the fame of its stock attracted a large attendance of breeders from various parts of the country. To Hon. Wm. Warfield we are indebted for many courtesies kindly extended to our party.

One thing that impressed me strongly was the fact that, while there were many grand herds of cattle in this section, where Short Horns have been bred for sixty years (so long one would suppose that all vestiges of the scrub would be obliterated), there were after all a good many natives, or at least many inferior grades, an evidence of the prejudice or shortsightedness of the average Kentucky farmer.

We purchased two yearling heifers, Miss Bates 21st at $355 and Woodburn Kirklevington 2d at $500, both sired by the imported bull 2d Duke of Whittlebury 62574. Their breeding is excellent, and we expect they will prove quite an acquisition to our herd.

In closing this report I desire to express my obligations to those who have assisted me in carrying on the work of the department, and who have necessarily had much to do with the details of management.

Any success achieved in my work is largely due to the unwavering sympathy and support of the State Board of Agriculture. I can only hope by conscientious devotion to the duties they have entrusted to my hands, to show how fully I appreciate their confidence.

SAM'L JOHNSON,
Professor of Agriculture and Superintendent of the Farm.

Agricultural College, June 30, 1887.

REPORT OF THE CHEMICAL DEPARTMENT.

President Willits:

In presenting the report of the chemical department for the current year, permit me to congratulate you on a year of successful administration and of prosperity in the college as a whole. In the chemical department the students have never been more earnest in their studies or more devoted to their work. The order, both in class-room and laboratory, has been unexceptionable.

One hundred and seventy-five students have received instruction in the laboratory during the year. The instruction has been both theoretical and practical. The plan of having the students perform the experiments for themselves, under the supervision of the teacher, to impress indelibly upon the mind the principles of a science by demonstrating the facts by personal experiment, and thus become familiar with the manipulation of apparatus, has been more fully carried out in the instruction in this department than in any former year. While this adds largely to the labors of the teacher it awakens enthusiasm in the student.

The details of class-room instruction and laboratory work need not be stated here. By frequent visits to lectures and class work in the laboratory you have kept yourself well informed of the kind and quality of instruction.

OUTSIDE WORK.

During the year a number of analyses of soils from the sandy plains of our northern counties have been made preparatory to an investigation of the agricultural capabilities of the pine barrens. Many specimens of molds, mucks, mineral specimens, etc., have been sent here for analysis for the information of the pioneers of our newly settled counties. Settlers asking for advice and information have come from all parts of the State. While making serious demands upon the time of the teacher, such intercourse keeps the college and the industrial classes in sympathy with each other. The number of hours a teacher spends in the class-room is an inadequate measure of the real amount of work he performs or of his usefulness to the public.

FARMERS' INSTITUTES.

It is now twelve years since the college management inaugurated Farmers' Institutes, sustained by the joint labors of the farmers and teachers, to be held at favorable points in the State. These Farmers' Institutes have spread into many other states. In some of these states the number of institutes has been increased to sixty or more, and we seem to be eclipsed while still adhering to our original half dozen. But our institutes have from the first been planted among the farmers, have owed their success to the hearty co-operation of the farmers and their addresses and essays, and have taken root among the farmers themselves. In almost every place where a Farmers' Institute has been held a local institute has been formed and similar meetings have been sustained year by year in such communities. The institutes in our State have been seed-sowing rather than harvest, and the harvest home of this seed-sowing comes in bettering farming, better feeling and happier homes as the years roll 'round. The test for our institutes is not "how many?" but "how fruitful?" Judged by this standard, Michigan can still hold up her head.

I attended the institutes at Grayling and Fremont. The meeting at Grayling was one of peculiar interest, the principal topic for discussion being the subject of "farming on jack pine lands." It was a live topic and handled with rare ability by the hardy farmers present. The subject is one of great importance to our State.

INSPECTION TOUR.

In the short vacation in May I visited several Agricultural Colleges and experiment stations in New York and Ohio, and took the opportunity to visit the sand barrens near Syracuse which, by skillful and scientific management, have been changed to fruitful farms.

COMMERCIAL FERTILIZERS.

The inspection and analysis of the commercial fertilizers offered for sale in this State, as required by law, have been duly made and reported in Bulletin No. 27. So far as information has been received, only one firm has failed to comply with the law, and the facts in the case have been duly reported to a member of the Board of Agriculture for action.

METEOROLOGICAL OBSERVATIONS.

The complete meteorological observations so long carried out at the college have been continued during the year, and the results published for information of the public. In addition to these tri-daily observations, a set of soil thermometers to measure the temperature at three, six, nine and twelve inches below the surface of the soil, has been bought and placed in position, and records kept of the temperature at these several depths.

I have also taken the temperature of the water in the Cedar river from time to time. Except in periods of flood this river is largely fed by springs, and the temperature of the water in the river thus becomes, to some extent, a measure of the soil temperature, and thus denotes the march of the season. I find the temperature of the river water to-day (37°) is twelve degrees colder than it was one year ago to-day, and forty-seven degrees colder than it was in our heated term (July 18). Observations on the temperature of water in rivers and lakes, if carefully and systematically carried out, might develop facts of interest both to science and common life.

Respectfully submitted,

R. C. KEDZIE,
Prof. Chemistry.

Agricultural College, Nov. 1, 1887.

REPORT OF THE PROFESSOR OF BOTANY AND FORESTRY.

To Hon. Edwin Willits, President of the State Agricultural College:

Please accept the following brief report of the department which is under my charge. The time included is nine months, viz: from September 30, 1886, to June 30, 1887. During the autumn term seventy-five sophomores were instructed in systematic botany, and twenty-one students in the mechanical course were instructed in the use of the compound microscope and the study of timber.

In the spring term, sixty-one sophomores studied physiological botany, aided by compound microscopes. In the summer term, at the time of writing this report, seventy-two freshmen are studying structural botany, and twenty-two seniors, with a few others, are studying forestry.

In addition to this, during one or more terms of the year, there have been four resident graduates, or special students, pursuing some studies in botany. Some dozen or more students are each collecting specimens and giving special attention each to one order of plants. Quite a large number call in to be assisted in some special topic which they prepare for the natural history society or for some one of the literary societies.

So far as appears, some improvements are made each year in the course of instruction. It is customary for many professors in a college to try to get all the time possible in a course of study for the students in their own department, regardless of what may be left for other professors. During my connection with this college, since 1870, the time allotted to the study of botany has been five-sixths of a collegiate year of daily work. During this period botany has made wonderful progress. The plan of using compound microscopes in the study of physiological botany has become quite general, and is very popular. This takes one term of the year, and occupies time formerly given to systematic botany—the study of the natural orders which are most interesting or the most useful. During the term in which students can now elect still more botany, they can study forestry, fungi or the grasses. There is no denying the fact that however valuable may be the term devoted to physiological botany by the use of compound microscopes, teacher and students feel the lack of the "old fashioned" analysis of plants in which they learn the names and uses and the habitats of many native plants.

The museum is constantly receiving additional specimens, mainly from my own efforts in collecting them. The arboretum has received perhaps a dozen new species, and the botanic garden has received about as many as have died during inclement winters or summers. I have spent more time this summer than ever before in studying the interesting flora of this neighborhood, and have made large collections for our local herbarium.

I attended and lectured at two of the six college farmers' institutes last winter—three others by special request; also, the meeting of the State Dairymens' Association held at Flint. Numerous other requests to lecture were declined, that I might find some time during the winter vacation for the study of grasses and the completion of my book on Grasses of North America. The first volume has been printed and contains about 470 pages. The favorable comments by teachers in Agricultural Colleges, the agricultural press and journals of science have been very gratifying, and better than I had reason to expect. The preparation of bulletins, lectures in the chapel to students and professors, answering numerous questions by letter, have occupied not a little time during the year. Full reports on preceding years seem to make a lengthy one unnecessary at this time.

DONATIONS.

Frank Kellogg, Agricultural College:
A small bottle in which grew root-stocks of quack grass.
R. B. Hough, Lowville, N. Y.:
20 samples of business cards made of red and silver maple.
W. Hilbert, N. Lansing, Mich.:
2 bunches of grass.
Ben. Haines, 41 Maine St., New Albany, Ind.:
2 sorts of Linaria Vulgaris.

Geo. E. Kedzie, Ouray, Col.:
Sends seeds of Aquilegia Cærulea to be tested.
J. G. Lemmon, San Luis Obispo, Cal.:
Package of seed of Tyetes Lemmoni.
Prof. E. C. White, Cincinnati, O.:
Sends from Peru, S. A., three lots Indian corn, some Ullinos and seeds of plants.
Royal Gardens, Kew, England:
Reports for 1881, '82, '84. Guide to museum of timber, 1886. Guide to Dicotyledons and Gymnosperms, 1886.
W. M. Badcock, New Providence, Union Co., N. J.:
20 unnamed dried English plants.
Botanical Division, United States Department of Agriculture:
25 packages of seeds of native grasses collected in Colorado.
Prof. James Satterlee, Lansing, Mich.:
7 shingles (shaved pine) that had been laid twenty-eight years in Lansing.
T. Bergy, Proprietor of Caledonia Button Works, Mich., through W. J. Meyers, '89:
Samples of vegetable ivory and forty buttons of the same material.
Mrs. M. J. C. Carpenter:
Collected in Arkansas fruit of gum tree, trumpet creeper and a gall of a rose bush.
Frank E. Wood, Hancock, Mich.:
4 living ferns.
United States Agricultural Department, through A. C. Lawrence:
Samples of blue stem wheat from Erwin, D. T.
Israel Wood, Delhi, Mich.:
Example of fasciation in willow. Galls on burr oak.

Respectfully submitted.

Sincerely your friend,
W. J. BEAL,
Professor of Botany and Forestry.

Agricultural College, June 30, 1887.

REPORT OF THE PROFESSOR OF ZOOLOGY AND ENTOMOLOGY.

President Edwin Willits:

The following is the report of my department for the past year:

In all the years of the college I have never known greater earnest and enthusiasm among the students, nor could students be more courteous and gentlemanly in their conduct and demeanor. Owing largely to your encouragement, we are able to do more laboratory work, and this kind of study, as it partakes of original research, is very highly appreciated by the students and is sure to receive their best efforts.

The course of instruction for the past year has been much as in previous years, except that now each student has work in the laboratory through the entire course. The time in the laboratory varies from three to six hours per week. This makes the work of the department very arduous, but the excellent results makes even the hardest work pleasurable.

The classes for the past year have been much larger than previously. They have ranged from sixteen to forty-five. More and more the students are asking for special work in the department. It is not uncommon for several students to work Saturday and in leisure hours in the laboratory.

During the autumn term the laboratory work is so extensive that I must perforce give much of it into the hands of my assistant, Mr. C. P. Gillette, to whose earnestness and fidelity much of the success is due.

COLLEGE WORK OTHER THAN INSTRUCTION.

During the year I have given two public lectures before the entire college. Subjects: "History of the College," and "Unbidden Guests." I attended the Three Oaks and Bancroft institutes, and gave lectures at both places. I have prepared two bulletins during the year, which will appear in the report of the board. A portion of the year I have taught a large and interesting class in the college Sabbath school.

I think the inquiries received by mail during the year were never so numerous. I have answered all these as promptly as possible. Many experiments have been carried on during the year. These have been largely under the charge of Mr. Gillette. The character and results of these investigations are appended to this report.

THE APIARY.

The bees wintered without loss, but owing to neglect early in the season, which was entirely unavoidable, and will be till I can have more assistance, they did very poorly, yet they have held their own and go into winter quarters in good condition. During the year we have built a new building for the apiary, under my supervision. Before this was commenced, I drew a sketch of the proposed building and wrote a full description. This was copied in all our several American bee journals, and also in several English and German papers, and was commented upon by many of our best American and foreign apiarists. Thus I had the advantage of wide criticism, and I hope and think we have a model apiary. The position of the apiary, though not what I had hoped for, will, I think, prove very good.

This excellent apiary, together with our thorough and unique course of instruction, will surely bring us many students. Already our students are in demand for responsible positions, not only in the United States but also in foreign countries. It is very desirable that I should have an assistant to give his entire time in the apiary. This is the next stride forward which the department should make.

A sketch and description of the new apiary is appended to this report.

OUTSIDE WORK.

Last winter I wrote and had published quite a full treatise on "Maple Sugar and the Sugar Bush." An edition of 3,000 copies was issued. So far as I know it was the first work ever written on this subject. I also lectured before the Ohio and Wisconsin State Horticultural Societies, and the New York and Wisconsin Farmers' Institutes, subject to the consent and advice of yourself and the State Board of Agriculture. I also read a paper before the winter meeting of the Michigan State Horticultural Society, and prepared and delivered an address as president of the State Bee Keepers' Society. I have also spoken before several farmers' clubs during the year.

DONATIONS TO ZOÖLOGICAL DEPARTMENT.

F. J. Niswander: Alligator.
H. J. DeGarmo: Deformed femur.
C. B. Cook—mounted specimens:
Collared peccary.
Echidna.
Prairie dog.
Prairie wolf.
Kangaroo.
Mountain quail.
American bittern.
White ibis.
Long billed curlew.
Rough legged buzzard.
Australian thrush.
Sickle-billed humming bird.
Sword-beaked hummer.
S. A. Toucan.
Grass parakeet.
Swift lorikeet.
Green heron.
Campylorhynchus brunneicapillus.
Xiphocoloptes albicollis.
Falcunculus frontolus.
C. L. Rose: Fossil fish (3 specimens).
H. G. Hipp: Fossil coral.
C. H. Hoyt: Gizzard of goose (abnormal).
W. W. Diehl: Trilobite.
J. I. Ames: Emery.
Mr. Warren: Feather bone.
M. D. Osband: Work of pine borer.
C. B. Cook: Stuffed birds (7 specimens).
F. H. Hall: Fossils (2 specimens).
D. A. Hoffman: Fossils from Iowa coal (22 specimens).
J. F. Craig: Fossil baculite.
W. M. Byar: Orthis occidentalis.

Respectfully submitted,

A. J. COOK.

EXPERIMENTS OF DEPARTMENT OF ZOOLOGY AND ENTOMOLOGY.

PLUM CURCULIO (CONOTRACHELUS NENUPHAR).

Paris green in the proportion of one table-spoonful to six gallons of water was very thoroughly sprayed upon four plum trees May 18. The petals had all fallen, but the dried calyxes still clung to the fruit. On August 20 the trees were visited, when it was found that the two treated trees of the Wild Goose variety had dropped all their fruit, as had the untreated trees of the same kind. Another treated tree of a yellow variety was loaded with plums, of which only fifteen per cent were stung, and those not badly. The fourth tree treated was a purple variety, and had not less than seventy-five per cent of its fruit badly stung.

CODLING MOTH (CARPOCAPSA POMONELLA).

London purple, in the proportion of a heaping tea-spoonful to a pailful (three gallons) of water, was freely sprayed upon a crab-apple tree May 24. Heavy rains followed, and on June 6 the application was repeated. An adjacent tree, also crab-apple, was left untreated as a check tree. From each of these trees, July 1, two hundred apples were picked at random. The apples from the treated tree gave one codling moth larva and five curculio scars, while the untreated tree gave eight codling moth larvæ and thirty-two curculio scars. On September 20, when nearly all the apples had fallen, another count of 200 each was made, taking the apples from the ground. Those from the untreated tree gave ninety-one wormy apples, and those from the treated tree thirty-seven. The results were not as satisfactory as on previous years, possibly owing to heavy rains.

CURRANT WORM (NEMATUS VENTRICOSUS).

Soap suds made by dissolving one part of common soft-soap in three parts of water was applied by use of a cyclone nozzle to the under side of the leaves for the destruction of the eggs of the saw-fly. Some of the eggs turned and dried up, but most of them were unharmed and the foliage was somewhat injured by the application.

Kerosene emulsion made with whale oil soap, so that the kerosene should form one-twelfth of the mixture, was also used for the destruction of the eggs, in the same manner as the soap-suds, and with almost identical results. The one remedy that can always be relied upon to destroy the currant worm is white hellebore.

PLANT LICE (APHIDES).

Kerosene emulsion made with common soft soap, so that the kerosene should form one-eighth of the entire mixture, was freely sprayed upon snow-ball bushes for the destruction of the aphis eggs that were thickly scattered over every twig and bud. A well treated twig, on which were eggs in very large numbers, was taken into the laboratory and put in a glass jar. Only two or three lice ever hatched from the eggs on this twig. Another similar twig that was not treated was also put in a jar in the laboratory, and from it the lice hatched in large numbers. The contrast in numbers of lice on treated and untreated bushes out of doors was almost equally marked at first, but later the difference was not so great. This was perhaps due to the rapid increase of the few hatched upon the bush and to others hatched from eggs laid upon grass and rubbish near the roots of the plant. This experiment, and others tried upon the eggs of the apple aphis, seems to prove quite conclusively that kerosene emulsion of the strength above mentioned will destroy the great majority of the eggs if thoroughly applied.

APPLE APHIS (APHIS MALI).

A kerosene emulsion in which the kerosene formed one-fifteenth of the entire mixture was applied to the apple trees just as the buds were beginning to open. The young lice had nearly all hatched and were clustered together on the opening buds in large numbers. Over fifty lice in one case were counted on a single bud. Two days after the application the trees were again visited, when scarcely a live louse could be found. In a count of two hundred specimens only one live individual was found.

Whale-Oil Soap. Several experiments were made with this soap, which proved it to be nearly or quite equal to the kerosene emulsion for the destruction of the aphides. The strength used was one-half pound of the soap to four gallons of water.

Soft Soap. Common soft soap reduced in four parts of water was also found very efficient for the destruction of the plant lice.

CABBAGE MAGGOT (ANTHOMYIA BRASSICÆ).

Kerosene emulsion, strong soap-suds and London purple, in the wet way, were freely applied on Tuesdays, Thursdays and Saturdays of each week, beginning May 5, about the roots of early cabbages for the destruction of the cabbage maggot. This was continued until the flies had stopped their work of egg-laying. An examination of the plants at this time showed them to be nearly as badly infested with maggots as were the untreated rows. This does not prove that the substances had no effect to diminish the attack of the maggots. There was a red mite very numerous in the garden, and which ate great numbers of the eggs about untreated plants. It proves that the benefit of the insecticides did not much exceed the benefit of these little mites. Three of the mites were taken into the laboratory and fed upon fresh eggs to note their rations. Several days' feeding proved that these little mites would suck not less than fifteen eggs each every day. As it was common to find four or five of these little friends about a single plant, it can be readily seen that they were very helpful in lessening the number of maggots about the plants. In another patch kerosene emulsion, whale-oil soap, London purple and pyrethrum water were used as above, treatment beginning May 21, three days after the plants were set out. The kerosene emulsion was too strong and did the plants more harm than good. The rows treated with London purple and whale-oil soap did not lose quite as many plants as the untreated rows. The pyrethrum seemed to have no effect whatever.

ONION MAGGOT (ANTHOMYIA CEPARUM).

Rows of onions were also treated with insecticides as were the cabbages, but received more harm than good.

RADISH MAGGOT (ANTHOMYIA RAPHANI).

Kerosene emulsion, whale-oil soap, common soft soap, a strong tobacco decoction, and powdered charcoal were faithfully used about radish plants for the destruction of the radish maggots, but all to no effect. Not a bunch of marketable radishes was taken from the treated or untreated rows in the entire bed. We do not at present know of any application that is practicable for the destruction of the radish maggot. The location of the bed must be changed each season or else the flies must be shut out by means of gauze.

PARIS GREEN AND LONDON PURPLE VS. FOLIAGE.

These two arsenites, in the proportion of one pound to fifty gallons of water, were rather freely sprayed upon the foliage of the following trees and plants with the following results:

On apple the leaves became badly spotted with brown and some turned yellow and fell off. On the plum the effect was the same. On tame cherry every leaf fell. On peach all the leaves fell and all of the new growth died. On raspberry, potato, and summer and winter squash the poisons did no harm. On corn the leaves were much browned but were not killed.

PARIS GREEN AND LONDON PURPLE—EXPERIMENTS WITH.

These two arsenites as used by the department this season seemed to be equally efficient as insect exterminators, and their effect upon foliage was almost identical. It was no trouble to mix either with water, but the London purple mixed a little the quicker. The Paris green, however, settled much the quicker. Experiments proved that Paris green would settle as much in fifteen minutes as London purple would in an hour and a half.

Analysis proved the poison used to be unadulterated. An adulterated article used by another party gave much trouble in mixing with water and it did little good as an insecticide. London purple that will roll about like oil upon water is an adulterated article unfit for use.

The application of the insecticides to foliage in the above experiments was made almost entirely though the Nixon nozzle, manufactured by A. H. Nixon, Dayton, Ohio, and which gives excellent satisfaction. I know of no other that is equal to this.

The field force pump (Lockport, N. Y.) we think excellent for spraying large orchards. This runs by gearing attached to the wagon wheel.

The cyclone nozzle is especially useful in throwing a spray on the under side of the foliage of low bushes.

A HOUSE FOR THE APIARY.

The house is three stories—a cellar 7 feet high; first floor 8 feet, and chamber 6 feet at the lowest part. The cellar is for wintering bees; the rooms above are for honey, extracting, and shop; the chamber is for general storage. The cellar has two rooms. One, for bees in winter, is 18x24 feet. This is entirely under-ground, with a good stone wall, grouted below and plastered above, with a double floor grouted between—to secure against mice and cold alike, and with the partition wall double, with double doors. At the center of the partition wall a small chimney runs from the bottom of the cellar up to and through the roof. Just within the wall of this room is a small gutter which extends nearly around the room, as seen in the drawing, from one end of a cistern to the under-ground sub-earth ventilation-pipe which runs 200 feet or more under-ground. Thus this pipe of four-inch glazed tile serves for sub-earth ventilation, overflow-pipe for a cellar cistern, and it can be made to empty the cistern and cool the bee-cellar at any time, the water passing through the small gutter.

In the other room of the cellar, which is 8x24 feet, there is a cistern 8x14 feet, and 5 feet high. As will be seen, this extends 2 feet into the bee-cellar, yet the partition is tight, except a small hole just at the bottom, so we may say we have two cisterns—one a small one in the bee-cellar, the other a large one in the other cellar, though they are connected at the bottom. The other room, which is a sort of vestibule for the bee-cellar, has two windows—one

(1x2) by 2 feet, and stairs to the room above, which are covered by double trap-doors. This room is entirely under-ground, though the outer double door, which is 4 feet wide, is, because of a natural slope of the ground, on a level with the outside, or else is inclined so we can easily run a wheelbarrow into the cellar. The windows may receive light by a half-circular excavation, except on the east end where they are entirely above ground.

Here, then, we have an arrangement by which we can control the temperature perfectly from October to May; and from an experience extending now over eight years, I am sure that, with enough good food, bees are entirely safe in such a cellar. By aid of the cistern there is no occasion to use ice to reduce the temperature in spring; and we can, by aid of sub-earth ventilation and cistern water, keep the temperature just to our liking all through the winter, with almost no trouble and at no expense. This is no theory: it is demonstrated fact. As the bees can be wheeled into the cellar, their removal to or from the cellar is a very light task.

On the ground floor, which is on a level with the earth outside, there are three rooms. One on the southwest, 12x15 feet, is for extracting and extracted honey. It has a hard wood floor, wide outer door, and only one thickness of wall, so that in summer it is kept very warm, and so enables us to ripen honey without leaving it in the hive till it is all capped. This is also a demonstrated fact. The joists above are just so wide that they serve as frame supports. The windows are poised with weights, and these and the door have an outer gauze hinged frame. The gauze is so arranged that bees can pass out, but will not enter the room from without.

A second room on the southeast is also the same size, but is double walled, lathed and plastered. It contains a stove, but has no outer door. It is for comb honey, for an office, and has trap doors to cellar stairs. I find that some are not in favor of this room, but I think it very desirable.

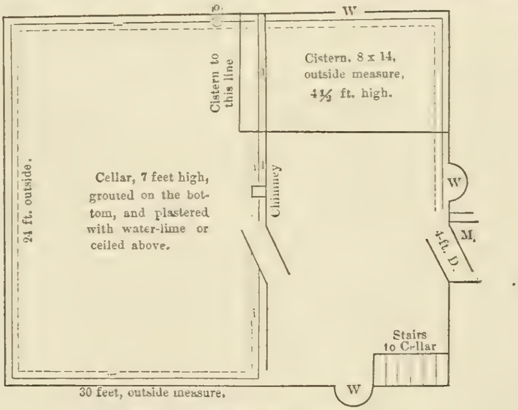
O
W
Cistern to this line
Cistern. 8 x 14, outside measure, 4½ ft. high.
Cellar, 7 feet high, grouted on the bottom, and plastered with water-lime or ceiled above.
24 ft. outside.
Chimney
W
M.
4-ft. D.
Stairs to Cellar
W
30 feet, outside measure.

Fig. 1. Diagram of cellar.

REFERENCES AND REMARKS TO FIG. 1.

D, 4-feet double doors.

i, gutter.

j, stone wall 4½ feet, or all the way up.

l, double wall lined with paper.

M, passageway from cellar, with stone abutments on each side, and level with outside, so a wheelbarrow can be run in and out.

O, drain of 6-inch tile—Dr. Miller says 10-inch—following the dotted lines 200 feet, and all the way below frost or variable temperature mark.

W, cellar windows, 1x2½ feet, double; outer glass, and inner wood. Both are hinged above so as to open in easily.

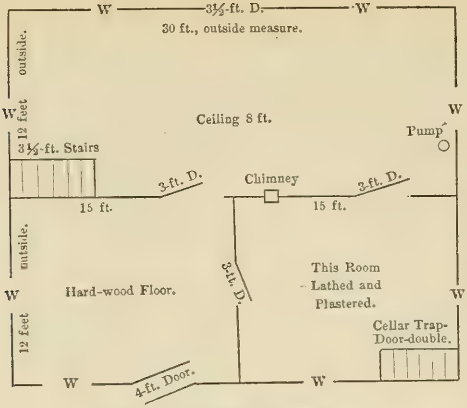

Fig. 2. Diagram of first floor.

REFERENCES AND REMARKS TO FIG. 2.

D, doors, the double one at the bottom having a sill so low a wheelbarrow can be run over it, outside door being of gauze.

W, windows, all of which have wire gauze screens outside, and hinged to swing out. Screens on four south windows to extend 4 inches above upper jamb, with ½-inch space.

Posts 14 feet. Studding, to chamber, alternate 12 and 18 inches apart (?) Side studding 12 feet long and 1 foot apart.

Floor, double, one foot apart, and with grouting.

Cellar and house mouse proof.

The entire north side of the building is for a shop. This is 12x30 feet. It has a pump from the cistern below, and stairs to the chamber above. It has an outside door, four windows, and a door into each of the other rooms. There will also be a stove in this room. In winter, then, when we have a fire in either room, the chimney will be heated, and the air drawn from the bee-cellar. The wind, too, passing over the chimney, will suck the air from the cellar. In both cases the air is supplied through the long sub-earth pipe, and is so tempered by the temperature of the earth, and is kept sweet and pure. This is both theory and demonstrated fact. This room is large enough so that a small engine and some machinery can be introduced if desired. I find that this house, large enough for a large apiary, can be built for $600; and for safety and convenience I believe it fills the bill. I cannot agree with Mr. Heddon that we had better have double-walled houses above ground. I think the cellar far better and more convenient.

A. J. COOK.

Agricultural College, Mich., June, 1887.

REPORT OF THE DEPARTMENT OF MATHEMATICS AND ENGINEERING.

AGRICULTURAL COLLEGE, October 1, 1887.

To Edwin Willits, President:

DEAR SIR,—I have the honor to submit the following report of the various interests in my care during the past year.

MATHEMATICS.

The following classes in mathematics have been taught during the year:

Fall term, 1886:

Freshman algebra, three classes taught by J. B. Cotton.

Sophomore algebra, three classes, taught by L. G. Carpenter.

Trigonometry, one-half term, three classes taught by Prof. L. McLouth,

Spring term, 1887:

Freshmen geometry, three classes daily, taught by J. B. Cotton.

Trigonometry and surveying, three classes daily, taught by L. G. Carpenter.

Summer term, 1887:

Geometry, three classes daily, taught by J. B. Cotton.

Analytic geometry, one class taught by L. G. Carpenter.

ENGINEERING.

Agricultural engineering, taught to seniors in fall term by R. C. Carpenter.

Civil engineering, taught to seniors in spring term by R. C. Carpenter.

DRAWING.

Free hand drawing, to the mechanical students, was taught in the fall term by Prof. L G. Carpenter, and to the agricultural students in the spring term by Prof. W. S. Holdsworth.

Mechanical drawing, occupying from one to three hours daily, was taught by Prof. R. C. Carpenter, fall term 1886, spring term 1887 and summer term 1887. The subject of drawing is now in charge of Professor W. S. Holdsworth.

Astronomy was taught in the summer term by Prof. L. G. Carpenter.

The subjects discussed in each of the above classes and text-books used are fully described in the catalogue, and it seems unnecessary to make a fuller statement in this place.

The amount of class work for each teacher has rarely been less than three hours, and sometimes has been as high as five hours per day.

MECHANICAL SHOPS.

The shops of the mechanical course have been in my charge since the opening of the course. On the first of September, 1887, they were turned over to Prof. W. F. Durand, professor of Mechanics.

The equipment of the shops has been much improved, and principally by the work of the students themselves. There have been constructed in the iron shop one turret lathe, fifteen inch swing, one engine lathe, fifteen inch swing, two engine lathes twelve inch swing, one pattern maker's lathe, and two lathes for the wood shop, besides a great number of small tools. These latter lathes were designed by myself and patterns made in the wood shop. There is in course of construction one twenty-horse power engine, one fifteen inch engine lathe, and two iron lathes for the wood shop. Every tool completed has added to the efficiency of the shop. A universal milling machine has been needed perhaps more than any other one tool. I am pleased to see that since Prof. Durand has been in charge of the shop this has been purchased.

The work in the wood shop is principally educational, and has been devoted largely to models. A large number of useful articles and a great deal of repairing has been done, however. The work in this shop has shown a steady improvement since the opening of the shop, due principally to improved facilities. In the fall of 1885 the wood shop had but six sets of tools, and students did what work was possible in the old brick shop. In the fall of 1886 there were twelve sets of tools, and students had benches in the new shop. For fall of 1887 we shall have twenty sets of tools and all conveniences ready for systematic work, so that the work will probably continue to improve. There are at present three lathes for turning wood. More are urgently needed, but will be supplied in part or wholly by the iron shop. The shops made an exhibit of the products then completed at the State fair at Jackson, 1886, and at the Central Michigan fair, one week later: these exhibits attracted a great deal of favorable comment. Mr. James Wiseman is foreman of the iron shop, and has been since the shop opened. He is an excellent workman, and an able manager of students.

Mr. H. Campbell, foreman of the wood shop, has been at the college one year, and has amply proved his ability as a workman and a manager.

ADDITION TO MECHANICAL BUILDING.

I prepared working drawings and specifications for the addition to the mechanical building. This addition consists of an extension of the present shop sixty feet long, with an addition of a blacksmith shop 30x30 feet, one story high. The lower story of the main shop is to contain a testing room 44x50x16 feet. The contract for this building is let to Eli Spross, contractor, for $3,000. I am also acting as superintendent of construction.

Steam Works.

Mr. Richard Hiscock is employed as engineer and Mr. James Edgerly as fireman. They have done all needed repairs for the steam works and a good deal of outside work. Mr. Hiscock did most of the skilled labor on the water works.

The iron shops of the mechanical department rebuilt an old Niagara pump, which had formerly been used for pumping, and this has proved efficient and a very desirable addition to our steam pumping facilities.

I prepared plans and specifications for two new boilers, each twelve feet long by five feet diameter; the contract was let to the Lansing Iron Works. The boilers are not yet completed, but will be finished and set before December 1, 1887.

WATER WORKS—ARTESIAN WELL.

Under the superintendence of Secretary H. G. Reynolds an artesian well was drilled near the boiler house. The first flow was obtained at a depth of 105 feet, the main flow at a depth of 260 feet. The well was continued to a total depth of 343 feet without greatly increasing the flow. The head was sufficient to impel some portion of the water up to a total height of nine feet above the surface, although the main statical head seems to be about five and one-half feet. The flow through a five-inch pipe was nine gallons per minute five feet above the surface, eighteen gallons per minute two and two and one-third feet above the surface. With a steam pump the amount was increased to 130 gallons per minute.

Dr. R. C. Kedzie made several analyses of the water, and reported it in each case of excellent character.

The work of connecting the well to the pumps was performed by this department. A six-inch pipe was laid from the pumps, outside the boiler house, and then reduced to a four-inch pipe, which was connected with the inside casing of the well. These precautions were taken so that in the event of an increase in the water supply it will not be again necessary to make new pump connections.

The old connections of the pump with the river were not severed. Should our water supply be insufficient in case of a fire, connection can be had with the river by opening a valve. It does not seem, however, that this will ever be necessary, for the well has more than filled our most sanguine expectations. We can, if necessary, pump from it from three to four barrels per minute.

The main line of six-inch pipe, which formerly ended west of College Hall, was extended 1,300 feet to a point beyond the house occupied by Professor Durand: also a branch six inches in diameter was extended 300 feet to a point east of Professor Johnson's house. From these respective points one line was continued west to the President's house, the other line east to the apartment house location, another branch was laid to the location of the new dormitory, these latter being four inches in diameter.

A hose cart and 200 feet of best fire hose two and one-half inches in diameter were purchased. Fire hydrants of the Gaskell pattern were set near the various residences. This makes a total of eleven fire hydrants for two and one-half inch hose set on the grounds, two small hose carts and 450 feet of hose. Had we a well drilled fire company our facilities for fighting fire, except for a few buildings, would be equal to that of most cities. The tank in the tower of Williams Hall will be protected from frost either by heating or by some means of covering. The under-ground pipes are laid well below the reach of frost.

The above is respectfully submitted,

R. C. CARPENTER,
Professor of Mathematics and Engineering.

REPORT OF THE PROFESSOR OF ENGLISH LANGUAGE AND LITERATURE.

To the President of the College:

The work of the Department of English Language and Literature during the past year is so similar to that of the previous year, and my last report was so full, that I do not deem an extended report necessary at this time. I have the honor to submit the following:

The work has been divided between myself and Mr. Pattengill; and some aid has been rendered by Mr. Cotton, especially in the correction of the first written work of the sophomores and the bringing up of the freshmen conditioned in grammar. During the autumn term the work in English and elocution with the freshmen was given to my assistant, and I taught the class in General History. The text of *Swinton's Outlines* was carefully studied, and supplemented by such outside reading as the students could profitably do, and the instructor direct and control, and by such familiar lectures from time to time on important topics as the instructor deemed of advantage. The class numbered fifty-seven and was taught in two sections. I met a part of the freshmen two hours on Saturday mornings for declamation, there being more of this work than my assistant conld direct. I also met the sophomores two hours weekly, on Tuesdays and Fridays, for declamations and essays, there being one hundred and three in the class, each presenting three exercises. I met the juniors, numbering forty-seven, once a week for the reading of Shakespeare, the play chosen being *Much Ado About Nothing.* I met the seniors once a week for essays in English Literature. This class numbered twenty-three, and each student presented two essays, the subjects being taken from the works of the *Romantic Poets.* During this term each member of the junior and senior classes delivered one public oration after the regular morning chapel service, this exercise, like all the English work, being under my supervision.

During the spring term it was found that the sophomores in rhetoric could be taught in two sections instead of three, as had been planned; and these two sections were given to Mr. Pattengill, leaving myself only rhetorical work, Shakespeare, and a class of freshmen in English. This class, numbering fifty-six, and consisting of students entering at this time and not able to pass an examination in the work of the fall term, with a few who had failed in the fall, met every day for nine weeks, in the afternoon, and carefully traversed the subject as presented in *Whitney's Essentials.* This term, as before, I shared the rhetorical work of the freshmen with Mr. Pattengill, meeting sections of the class two hours every Saturday. I also superintended most of the rhetorical work of the sophomores, the exercises being one descriptive, one narrative and one argumentative essay from each member of the class, eighty-seven in number, and Mr. Pattengill and myself sharing about equally in the correction of the manuscripts. The juniors read Shakespere as in the previous term, this term reading *Henry IV.* They also each delivered one public speech. The sophomores met regularly Tuesdays and Fridays for the study of *Webster's Reply to Hayne.*

During the summer term my work varied but little from the work of the corresponding term of the previous year. Nineteen of the seniors elected English Literature, which extended through eight weeks. The texts studied were *Milton's Areopagetica,* Pope's *Essays* and *Epistles,* Burke's *American Taxation,* Johnson's *Rasselas* and *Lives of Dryden* and *Pope,* George Eliot's *Silas Marner, Select Poems* of Browning and Tennyson's *Locksley Hall, Locksley Hall Sixty Years After* and *Select Poems.* Thirty-six juniors, with a few special students, did the regular work in English literature. Kellog's edition of S. A. Brooke's *Primer of English Literature* was used as a text-book, and the selections in this book, as well as those in J. W. Hale's *Longer English Poems* and Swinton's *Forty Masterpieces* were carefully studied. Critical and biographical essays supplemented the regular work. More attention was given this year than before, to the study of the literature, and less to the study of its history, and the results seem to warrant the change. This term the seniors spoke in public. The juniors continued their Shakespere study, reading *Hamlet* and the seniors met once a week to read Milton. The usual commencement exercises were under my supervision, and closed the work of instruction for the year. I I have lectured once in public during the year on "*The Newspaper as a Popular Educator*," and attended two institutes, as regularly appointed, lecturing on *Good Literature at Home and in the Common School.* The spring vacation I utilized in visiting several colleges of the State, spending several days at Ann Arbor. I also attended the meeting of the National Teachers' Association, at Chicago.

Some changes have been made in the course of instruction which are worthy of notice. The English work in the mechanical course has been made to correspond with that of the agricultural course through the sophomore year, with a possibility of a parallel through the junior year. The Shakespere work has been made part of the requird course. The Logic has been put in the junior year, and made a required study. The public speeches have been made a part of the morning exercises. The written work, after the sophomore year, except the public speeches, is done in connection with some regular study in the course, Horticulture, Physiology, Literature, Political Science, French and Engineering. A definite time has been set in the program for the meeting of the lower classes for rhetorical exercises. All of these are gratifying, as showing the growing appreciation of the importance of thorough English work.

Some additional equipment in the way of dictionaries and charts has been made. The one pressing need now, as when I made my report a year ago, is an instructor in elocution. With the increased number of students, it grows less and less possible for the elocutionary work to be satisfactorily done without the services of a man who can give his entire time to it.

All of which is respectfully submitted.

E. J. MacEWAN,
Professor of English Language and Literature.

REPORT OF THE ASSISTANT PROFESSOR OF ENGLISH LANGUAGE AND LITERATURE.

To the President of the College:

I have the honor to report the following as my portion of the work in English for the year 1886–87:

FALL TERM—GRAMMAR AND ELOCUTION.

The fall term of 1886 was devoted to the study of English Grammar, with *Whiting's Essentials of English* as a text-book. The object kept constantly before us was to develop the thinking power of the student, to render him familiar with the structure of sentences as found in classical English, and to cultivate the faculty of correct speech, of accurate spelling, and of tidy and business like make-up of written exercises. As an auxiliary to the work of analyzing sentences, the class was drilled in diagraming sentences according to the plan laid down by Reed and Kellogg.

The freshman class of this term numbered 100, and was divided into three sections. Each section coming before me daily for three months. These students also received from me semi-weekly instruction in elocution or voice culture, and each one was required to recite two declamations before the pupils of his section. The selections were confined to choice prose compositions by classical English and American writers. In this connection I wish to emphasize the suggestion made by Prof. MacEwan in his report of last year, that a permanent instructor be secured to take charge of the elocutionary work. The subject is an important one, and there is plenty of work fully to employ one person's time.

SPRING TERM—RHETORIC AND ELOCUTION.

My work during the spring term was with the sophomore class in rhetoric. The text-book used was A. S. Hill's Principles of Rhetoric. The aim in this study is to give the pupil power to express thought with clearness and force, to enable him to collect and arrange material in narratives, descriptions, and arguments. Besides a careful study of the text, each pupil was required to write a descriptive essay, a narrative essay, and an argumentative speech.

There were in this class 87 students, divided into two sections. The written work required amounted to nearly 2,000 pages of manuscript, and in the correction of this I was assisted by Prof. MacEwan.

The freshmen also met me semi-weekly in elocution and voice culture. Each one gave two declamations. More attention was given to proper gestures than in the preceding term.

SUMMER TERM—ELEMENTARY RHETORIC.

The freshman class again came under my charge; this time to pursue the study of rhetoric, with D. J. Hill's *Elements of Rhetoric* as a text-book. Drill on the fundamental principles of rhetoric, actual practice each day in spelling, pronouncing, and analyzing words, careful preparation of papers in frequent written reviews, constituted the class-room work of the term. Each pupil, moreover, wrote and handed in the following: (1) A letter applying for a position; (2) a descriptive essay on a topic assigned; (3) a descriptive essay on a topic selected by the pupil; (4) a reproductive narrative based on *Paul Revere's Ride.*

There were in the class 90 students, divided into two sections. The manuscript work examined amounted to 2,160 pages.

The work of the year has gone along very pleasantly. The pupils of all classes have entered into the work with enthusiasm and with an apparent determination to succeed.

Respectfully submitted,
H. R. PATTENGILL,
Assistant Professor of English Language and Literature.

Agricultural College, November 1, 1887.

REPORT OF THE PROFESSOR OF VETERINARY SCIENCE.

To the President Michigan State Agricultural College:

Sir,—I have the honor to submit the following report of work done in the Veterinary department of this institution during the year 1886-7:

As has been the custom, our collegiate course began with the fall term of 1886, and our special line of work was directed towards giving a course of lectures, upon the anatomy of such domestic animals as the horse, the ox, the sheep, and the hog. The lectures during the term were first of all illustrated by means of very handsome and accurate paper models, obtained from the world-renowned Dr. Auzoux's papier-maché model manufactory in France; and also a number of well prepared skeletons, put up in this country.

Having disposed of our subject in the class-room, the students purchased a horse, and we reviewed the anatomy of it again in the dissecting room. I would here like to say that practical dissection has become so popular with our senior students that the faculty have recently added it to the required course in veterinary science, and provision is made in our present catalogue for it, during the latter part of the fall term.

The spring term of 1887 was devoted to lectures upon the diseases of those organs which we had been studying the anatomy of during the autumn, and which occupied our attention for the first four days of the week, the last of the week being given up to materia medica. When it was possible for me to do so, I performed operations upon living subjects before the class, and showed them how to secure and restrain animals under different circumstances.

The summer term of this year began with a description of the examination of horses for soundness prior to purchase, conducted first of all in the class-room, with diagrams as means of illustration; and then in our operating room, with live horses to illustrate our points. We then continued our course from day to day upon pathology and materia medica, not forgetting to introduce the live animal at all times, when it was possible to do so.

I may add that the steady growth of our museum assisted me in illustrating the pathological changes which take place between health and disease in a manner that I had not been able to do before, for want of certain actual specimens.

Besides my regular class work, I delivered my Wednesday afternoon lecture in the chapel in order, and issued my semi-annual bulletins according to law. In the capacity of State Veterinarian I have attended to the requirements of the State Live Stock Sanitary Commission, and have had the honor of being reäppointed to the office by our present governor. I attended four of our Farmers' Institutes during the winter of 1887.

In the early part of the present year I received a request from Purdue University of Indiana to give a course of sixty lectures there, during our vacation, but through unforeseen circumstances will not be able to do so.

I have also been requested to deliver a course of eight lectures at the Farmers' Institutes of Wisconsin, which I hope to be able to accomplish during the coming winter.

At the annual meeting of the Michigan Veterinary Medical Association I was elected president of that society, and have read papers upon veterinary topics at both its meetings this year.

I have attended to the veterinary requirements of the live stock in the Horticultural and Agricultural departments of this college when requested to do so. I have the honor to be, sir,

Yours obediently,
E. A. A. GRANGE,
Professor of Veterinary Science.

Agricultural College, Mich., October 1, 1887.

REPORT OF PROFESSOR OF MILITARY SCIENCE FOR 1886-87.

President Michigan Agricultural College:

SIR,—I have the honor to render the following report of the condition of the Military Department at this college since my last annual report:

Number of infantry drills, with an average attendance of 92 cadets	177
Number of dress parades, with an average attendance of 60 cadets	20
Number of target practices, with an average attendance of 12 cadets	12
Number of recitations in tactics, with an average attendance of 15 cadets	35
Number of lectures on military subjects, with an average attendance of 75 cadets	6

In addition to the above I delivered a public lecture in the chapel on July 6, upon the present condition of the French army, the result of personal observations in Europe during my recent trip.

Two companies of cadets, numbering about sixty, attended the Fourth of July celebration at Flint, participating in the street parade, and giving an exhibition drill. About the same number of cadets attended the State fair at Jackson, in September. In both instances all of the expenses of the cadets were defrayed by the citizens of the two above mentioned cities.

A competitive drill between the two companies of the college cadets was held on July 28, for the honor of carrying the colors during the ensuing year. The decision was in favor of "A" company, commanded by cadet captain Irving Bates. First Lieutenant F. L. Dodge, 23d regiment U. S. infantry, kindly consented to act as judge upon this occasion.

During the year two gold medals were awarded to cadets D. A. Smith and J. W. O'Bannon, for good marksmanship, the medals being purchased with money ($14.50), contributed for the purpose by the faculty and other officers of the college. Cadet W. J. O'Bannon was also the recipient of a silver medal, offered by myself for special excellence in the manual of arms in an individual competitive drill.

Within the year the flag staff, presented to the college by a former student, has been erected in front of the armory, and the regulation U. S. flag and the Signal Service weather flags are daily displayed thereon.

SUMMARY.

The period of my detail at this institution being about to expire, and my successor having been appointed, it may be of interest to summarize what has been accomplished for the new department with which I have been connected since I reported for duty three years ago. At that time there was no military organization whatever. Before the expiration of the first year the present placed armory, which is planned in accordance with my suggestions, was completed, and the necessary arms were obtained from the U. S. ordnance department and placed therein. Meanwhile a battalion of two companies was enrolled, uniformed and daily infantry drills in the schools of the squad, company and battalion were begun, and have been carried on without intermission during each college year. At present the battalion consists of 150 cadets. Drill is now compulsory for all students at certain stated periods during the four years' agricultural course. The interest of the students in military matters continues unabated, and the conduct of those under me has, with few exceptions, been entirely satisfactory.

The last legislature having authorized the erection of suitable quarters for the professor of military science, the officers who follow me will be spared the inconvenience and expense to which I have been subjected, consequent upon necessarily living off of the college grounds.

RECOMMENDATIONS.

In my opinion the usefulness of this department would be vastly enhanced and the *morale* of the students improved by transferring the discipline of the students to the Military Department. The dormitories would then be subject to systematic daily inspection, absentees from any college exercise would at once be reported and accounted for; students would march to classes, to work and to drill in orderly sections, instead of straggling along as they now do; and I am confident professors would be saved much annoyance, and the president, especially, a great deal of the arduous work of enforcing discipline, which now consumes so much of his valuable time.

I respectfully invite attention to the fact that the rules of the college need early revision, especially with a view to affixing proper penalties for absences from drill.

Very respectfully your obedient servant,

J. A. LOCKWOOD,
Lieut. 17th U. S. Infantry.
Professor of Military Science and Tactics.

Michigan Agricultural College, October, 1887.

REPORT OF THE LIBRARIAN.

To the President:

The number of students using books is a gratifying indication of the work done in the class-room; never before have there been so many students doing regular reading in the library; the helps to the reader are greater than ever before, and are mainly found in the indexes and catalogues, now ready for use.

Catalogues.

There are three catalogues, or indexes, viz: The author's catalogue, the title catalogue, and the subject catalogue. Only the author's catalogue is complete; the title catalogue will be complete early in the coming year; the subject catalogue, as far as present experience goes, is quite an endless matter. All the pamphlets are now subject-catalogued and a great many books, but the majority of the books are yet untouched. There are more than 16,000 subject cards, many of them having two or more references, so that there are easily 40,000 references, and, as far as possible, students are taught to make use of them; a printed card explains the matter, and a great many students have mastered the subject. A case for the cards is being made by the mechanical department.

Gifts—Bound Volumes.

The following is a list of the bound donations, together with the names of the donors:—

Agriculture, Department of, Washington—Bureau of Animal Industry, Vol. 2 and Report of Commissioner, 1886.

Bailey, Prof. L. H.—Three Horticultural Reports.

Baker, Dr. H. B.—Vol. 13, Report State Board of Health.

Bates, Irving Belcher—She.

Brown, Dr. J. C.—11 Reports on Forestry.

Carpenter, M. J.—6 vols., miscellaneous.

Chamberlain, Hon. H.—Michigan Census Report, 1884.

Draper, Daniel—Memoir of J. W. Draper. Reports of New York Meterological Society.

Education, Bureau of—Exhibit at New Orleans 1884-5, part 1. Report, 1884.

Garfield, Secretary C. W.—11 Horticultural Reports.

Goodale, Prof.—Report of Massachusetts Agriculture, 1886.

Holmes, Howard M.—3 vols. George's works.

Interior, Department of—Patent Office Reports, 5 vols. Miscellaneous, 10 vols.

Koons, B. F.—Connecticut Agricultural Report, 1886.

Labor—Second Annual Report of United States Commissioner of.

Lockwood, Lieut.—Military Laws United States and Michigan.

McWhirter, A. J.—Agricultural Report, 1887, Tennessee.

Mills, President James—Report Ontario Agricultural College.

Pond, Hon. C. V. R.—Fourth Report Bureau of Labor.

Porter, President J. L.—Queen's College Catalogue, 1886-7.

Quebec—5 vols. Legislative and other papers.

Reid, E. B.—Report Entomological Society, Ontario.

Ross, Hon. A. M.—Agriculture and Arts, Ontario.

Sims, Wm.—Fifth Biennial Report of Kansas State Board of Agriculture.

Smithsonian Institution—Report of, part 1, 1885; 3 vols. miscellaneous collections.

Spaulding, Hon. O. L.—Tenth Census of United States.

Stevens, Hon. W. C.—Report of Auditor General of Michigan, 1886.

Storrs, Hon. L. C.—Board of Corrections and Charities Report, 1885-6.

Tenney, Mrs. H. A.—Vol. 8, Michigan Pioneer Collections. Vol. 56, Michigan Supreme Court Reports. Statutes First Session Forty-ninth Congress, 1885-86.

Treasury Department—Coast Survey Report, 1885. Commerce and Navigation of United States. Internal Commerce. Report of Comptroller of Currency.

War Department—Official Records, War of Rebellion. Reports of Chief Signal Officer, 1885. Reports of Lieutenant General of the Army.

Gifts—Pamphlets.

Pamphlet donations have been received as follows:

Agriculture Department, of Washington—Shade Trees and Insect Defoliators. Fungus Diseases of Grape Vines. Manufacture of Sugar Canes and Sorghum. Freight Rates, Crops, Transportation. Foods and Their Adulteration. Practical Work in Entomology. Grasses of the South.

American Live Stock Manual, unknown.

Bailey, Prof. L. H.—Synopsis of North American Carices.

Baker, Dr. H. B.—Reprints Michigan State Board of Health Reports.

Clute, Rev. O.—Golden Wedding.

Cook, Prof. A. J.—Maple Sugar and The Sugar Bush.

Education, Bureau of—Bulletins.

Essex Institute—Bulletins of.

Experiment Stations and Bulletins—Alabama, California, Connecticut, Georgia, Indiana, Iowa, Louisiana, Manitoba, Massachusetts, New Jersey, New York, North Carolina, Ohio, Ontario, South Carolina, Vermont, Wisconsin.

Fairchild, President G. T.—Fifth Biennial Report of Kansas State Agricultural College.

France—Annuaire de la Société des anciens élèves de Grand Jouan. Bulletins de le Ministere de L'Agriculture, de la Société D'Agriculture et de Commerce de Caen, de la Société Nationale d'Agriculture et de la. Société centrale du department de L'Herault.

Garfield, Hon. Charles W.—31 pamphlets on horticulture.

Hess and Norton—Hand books of Arkansas City.

Hilgard, Prof. E. W., University of California—Irrigation and Viticulture.

Ingersoll, President C. L.—Fourth Report of Chamber of Commerce, Denver.

Interior Department—Reports of Commissioner of Patents.

Jamaica—Annual Report of Public Gardens.

Janes, Thos. P.—Scientific Manual.

MacMillan, Wm.—Reports Buffalo Park Commission.

Manning, R.—Massachusetts Horticultural Society, part 1, 1886.

Magyar, Tudományos Akadémia—39 miscellaneous works.

Patent Office—Gazette.

Peebles, Rev. A. B.—Handbook on Mormonism.

Pond, Hon. C. V. R.—Statistics of Labor.

Smithsonian Institution—Home and foreign exchange list.

State Department—Consular Reports, 12 nos.

Tamari, Hon. Kizo—Japanese catalogues.

Thorburn, J.—Geological and Natural History Survey of Canada, 1885.

Verona—Memorie del Accademia d'Agricoltura arti e commercio.
War Department—Official Army Register, 1887.
Williams, E.—New Jersey Agricultural Reports, 3 nos.

Books by Purchase.

Not many books have been bought during the past year, though a few excellent ones were taken rather than lose the opportunity of getting them.

Periodicals.

As usual our newspaper and magazine list is large. A complete list is as follows, viz:

Foreign, by subscription.

Agricultural Gazette,
Anglia,
Annales de Chimie et de Physique.
Art Journal,
Blackwood's Magazine,
Chemical News,
Edinburgh Review,
Engineer,
Engineering,
Englische Studien,
Fortnightly Review,
Garden,
Gardener's Chronicle,
Journal of Anatomy,
" Chemical Society,
" Horticulture,
Journal of Royal Agricultural Society,
Knowledge,
MacMillan's Magazine,
Nature,
Nineteenth Century,
North British Agriculturist,
Observatory, The,
Quarterly Review,
Scottish Review,
Spectator,
Sotheran's price current of books,
Times, Weekly, London,
Veterinarian,
Veterinary Journal,
Westminster Review.

American, by subscription.

Agricultural Science,
American Agriculturist,
" Bee Journal,
" Bookseller,
" Architect and Building News,
" Chemical Journal,
" Cultivator,
" Garden,
" Journal of Mathematics,
" " Science,
" " Comparative Medicine and Surgery,
" Library Journal,
" Machinist,
" Meteorological Journal,
" Microscopical Journal,
" Naturalist,
" Veterinary Review,
Andover Review,
Annals of Mathematics.
Army Journal,
Art Amateur,
Atlantic Monthly,
Banker's Magazine,
Boston Journal of Chemistry,
Botanical Gazette,
Breeder's Gazette,
Canadian Entomologist,
Century,
Chicago Tribune, daily,
Christian Union,
Contemporary Review,
Country Gentleman,
Critic,
Detroit Free Press, daily,
Detroit Tribune, daily,
Dial,
Drainage,
Education,
Electrical World,
Engineering News,
Entomologica Americana,
Gardener's Monthly,
Harper's Monthly,
" Weekly,
Hog, The,
Iowa Homestead,
Iron Age,
Journal of Education,
" Franklin Institute,
" the Military Service Institution,
Library Notes,
Literary World,
Littell's Living Age,
Magazine of American History,
Manufacturer and Builder,
Mathematical Magazine,
Mechanical Engineer,
Metal Worker,
Michigan Dairyman,
" Farmer,
Microscope, The,
Mirror and Farmer,
National Live Stock Journal,
New England Homestead,
New York Independent,
" " Nation,
" " Tribune, weekly,
North American Review,
Ohio Farmer,
Outing,
Popular Science Monthly,
Poultry World,
Prairie Farmer,
Public Service Review,
Quarterly Journal of Economics,
Railroad and Engineering Journal,
Rural New Yorker,
Sanitary Engineering,
" News,
Science,
Science Observer,
Scientific American,
" " Supplement,
Shakspeariana,
Sideral Messenger,
Southern Cultivator,
U. S. Govt. Pubs. Monthly Catalogue,
Vick's Monthly,
Wallace's Monthly.

This list will be slightly altered for 1888, some of the above being dropped and others added.

Through the courtesy of friends we receive a great many excellent helps which we could not otherwise have; there is nothing more appreciated by the student than his county paper, although he may not feel able to subscribe for it; our thanks are due to all publishers and others who remember us. We have been asked, sometimes, to send the Speculum in exchange; the Speculum is a students' paper, edited, published, and controlled by them, and outside the province of college officers.

The following papers are donated by publishers or others.

Albion Recorder,
Allegan Gazette,
American,
  " Beekeeper's Magazine,
  " Chemical Review,
  " Dairyman,
  " Farmer,
  " Garden,
  " Missionary,
  " Sheep Breeder,
Appleton's Literary Bulletin,
Battle Creek Journal,
Bee and Poultry Magazine,
Benton's Bees,
Cincinnati Grange Bulletin,
Charlotte Republican,
Charlevoix Journal,
Chicago Medical Times,
Christian Register,
City and Country,
Clinton Independent,
Coldwater Republican,
Daily Live Stock Commercial,
Deaf Mute Mirror,
Duncan's Monthly Magazine,
Farm, Field and Stockman,
Farm and Fireside,
Farmer's Advocate,
  " Budget,
Farm, Herd and Home,
  " Home,
Flint Globe,
Fruit Grower's Journal,
Fruitman and Farmer's Guide,
Gleanings in Bee Culture,
Good Health,
Grand Haven Herald,
Grand Traverse Herald,
Grange Visitor,
Hillsdale Leader,
  " Standard,
Holstein Friesian Record,
Imports and Exports to U. S.,
Industrialist,
Ingham County News,
Ionia Sentinel,
Journal D'Agriculture,
  " N. Y. Microscopical Society,
Kalamazoo Telegraph,
Lansing Journal,
  " Sentinel,
Literary News,
Locomotive,
Medical Missionary Record,
Microscope, The (Detroit),
Midland Republican,
  " Sun,
Monroe Commercial,
Naturalist's Bulletin,
National Live Stock Weekly,
New England Farmer,
New Farm,
Official Gazette,
Orchard and Garden,
Ouray Times,
Popular Gardening,
Practical Farmer,
Saginaw Morning Herald,
School Moderator,
Scientific Roll,
Sorghum Grower's Guide,
St. Louis Leader,
State Republican (Lansing),
Sun, The,
Three Rivers Tribune,
Traverse Bay Eagle,
Unitarian Review,
Union Signal,
Watchman,
Weekly Globe and Canada Farmer,
Western Resources,
Wolverine Citizen.

Suggestions.

Since the mechanical department has been added there has been a new set of interests to consider, viz., those of the mechanical students. These young men work in two divisions, the one section commencing at one o'clock, working until three, when they are excused and the second division takes their place, working until five; these last students are virtually closed out of the library except in the evening. My first suggestion is that the library be open hereafter at one o'clock p. m. instead of three, and that the librarian have a student assistant to keep the library open from half past six until half past eight in the evening. This will give an open library eleven hours a day, ample time for all classes of students, while the daylight is better for cataloguing, indexing and other library work. The evening help is almost necessary unless the librarian does injustice to herself.

My second suggestion is not a suggestion so much as a hope, that we may eventually have a good clean light to take the place of kerosene. The rooms are much better lighted than formerly, but the light is far from being the best library light.

In closing, it may not be amiss to say of the students that their manly courtesy and earnestness in work have been a great help and pleasure to me.

Very respectfully,

MARY J. CARPENTER,
Librarian.

LIST OF EXCHANGES AND WANTS OF THE MICHIGAN AGRICULTURAL COLLEGE LIBRARY.

Exchanges.

Of each of the following works we have two or more copies, and should be pleased to exchange with any one wanting them, for books mentioned in the list of wants.

AGRICULTURAL REPORTS:
- California, 1852, 1863.
- Colorado, 1881, 1882.
- Connecticut, 1866, 1868, 1874, 1876–86.
- Georgia, 1883–4.
- Illinois, 1853–57.
- Indiana, 1852, 1853, 1879.
- Iowa, 1866, 1867, 1868, 1871, 1872, 1875–84.
- Kansas, 1874, 1876–78 1881, 1882, 1885, 1886.
- Kentucky, 1879.
- Maine, 1857, 1858, 1861–74, 1876–78, 1880, 1881, 1883, 1884.
- Manitoba, 1883.
- Massachusetts, 1852, 1855, 1857, 1864–75, 1877, 1878.
- Michigan, 1852–56, 1859, 1871–77, 1879, 1880, 1883–87.
- Missouri, 1865–68, 1878–84.
- New Hampshire, 1850–53, 1883.
- New Jersey, 1874–79, 1881, 1885.
- Ohio, 1860, 1862, 1865–80.
- Pennsylvania, vol. 1, 1877, 1878–81, 1884.
- Vermont, 1872, 1874–77, 1881–84.
- Wisconsin, 1851, 1852, 1861–71, 1880, 1881.

EXPERIMENT STATION REPORTS:

Connecticut, 1880, 1883–86.
Kansas, 1883, 1884.
Massachusetts, 1884, 1885.
North Carolina, 1883, 1884.
New York, 1883–85.
Ohio, 1885.
Wisconsin, vol. 4.

HORTICULTURAL REPORTS:

Colorado, 1882–84.
Illinois, 1868, 1870, 1876, 1880.
Indiana, 1881, 1882.
Kansas, 1881.
Maine, 1873, 1874.
Montreal, 1879, 1881, 1882, 1885.
Michigan, 1876–86.
Minnesota, 1874, 1876, 1879, 1883.
Missouri, 1880–82.
New Jersey, 1874, 1879, 1880, 1882.
Nova Scotia, 1884.
Ohio, 1885, 1886.
Ohio, Montgomery Co., 1878, 1880.
Pennsylvania, 1875.
Hovey's Gardeners' Mag., 9 vols. from 1857.
Barry's Brief Essays on Fruit.

MISCELLANEOUS:

American Agriculturist, bound vols. cl., 16, 18, 19, 20, 26, 27.
Same unbound, vols. 37, 42.
American Ephemeris, 1855.
Angell's Higher Education Accessible to All.
Annals of Congress, 1789, 1824, 42 vols. cf., in good condition; would prefer to sell.
Brown's American Poultry Yard.
Consular Reports, many.
Contagious diseases, swine, U. S., 1880.
Dunwoody's rainfall, temperature and crop production.
Education, U. S. annual report, 1885–6.
Education, Bureau of, Bulletins, Nov., 1872, Nos. 1, 2, 1873, 1880 complete; also leaflets, 1885, Nos. 1, 3, 4,
Farm Statistics, Mich., five vols. bd.
Food and Food Adulteration, Richardson
Forestry, U. S. reports 1884.
Forestry, government timber lands, 1884.
France, bulletins French Ministère d'Agriculture, Geology.
Health, Mich. St. Bd. of, some reports.
Hedges, sugar cane culture.
Index to Gov't Agr'l Repts., 1877, 1885.
Labor Comm'r U. S., 1st and 2d annual reports.
Michigan and its resources.
Michigan Journal Education, pts. of vols. 5, 6, 7.

MISCELLANEOUS—*Continued:*

Michigan Teacher, vols. 6, 10, unbound.
" " " 8, Nos. 1 to 8.
Morton's Happiness.
Packard's Hessian Fly.
Riley's Shade Tree Defoliators.
Sheep Husbandry in U. S.
Signal Service reports, 1879.
Finley's 600 Tornadoes.
Slagg's Sanitary Work.
Smithsonian Report, 1864.
Spalding's English Literature.
Transactions American Institute, 1851, 1852, 1862.
United States Civil Service Comm., 1st, 2d and 3d, reports.
Vasey's Grasses of the South.
Wallace's Mo., parts of vols. 1, 2.
Warder's Hedges and Evergreens.

Wants.

The following books we desire to secure in exchange for duplicates mentioned above:

AGRICULTURAL REPORTS:

California, 1861–2, 1884, any since 1885.
Colorado, any except 1881–2 and 1886.
Illinois, any since 1882.
Indiana, first four reports; 11 to 24 inclusive, 26 and 28, and any since 1883.
Iowa, any since 1884.
Maine, any since 1884.
Massachusetts, 27, 28.
Michigan, 1871 and earlier; 1875, 6, 7 and 8, 1881, 2 and 3.
Minnesota, all except 2d biennial.
Nebraska, any except 1870, 1873.
New Brunswick, any except 1868–69, 1876, 1878.
New Hampshire, vols. 3, 6, 7, 8, and any since 1884.
New Jersey, any since 1885.
New York, 1842, 1843.
Ohio, 1854, 5, 7, 8, 1877, 1881 and all since 1882.
Ontario, 1872–3, and any since 1875.
Pennsylvania, any since 1884.
South Carolina, any since vol. 3.
Tennessee, any except 1887.
Wisconsin, 1860, 1874–5 and all since 1881.
Agricultural reports and standard works on agriculture always wanted

HORTICULTURAL REPORTS:

California, any except Nevada Co.
Georgia, " but 2d.
Illinois, " since 1884.
Indiana, " except 4, 6, 7, 14, 17, 20, 21, 22, 23.

Horticultural Reports—*Continued:*

Iowa, any except 1872, 1880.
Kansas, 1 to 6 inclusive, 12 and any since 13.
Maine, 5 to 10 inclusive and since 1883.
Massachusetts, all of 1883 except pt. 1.
“ “ 1882 “ “ 2.
“ “ 1881 “ “ 1–2.
“ “ 1880 “ “ 1–2.
“ “ 1879 “ “ 2.
“ “ 1878 “ “ 2.
Minnesota, any since 1884.
Missouri, any before 1879, or since 1884.
Montreal, 1, 2, 3.
New Jersey, 5 and any since 12.
Nova Scotia, any except 1883–4.
Ohio, any except 9, 15, 17.
Pennsylvania, any except 16, 17, 20, 21, 23.
Western New York, any except 23, 25, 29.
Wisconsin, 1881–4 and any since 1885.
Horticultural works of any kind desired when not already in the collection.

Miscellaneous:

American Dairymen's Association reports, 1, 3, 7, 10, and any after 12.
American Journal of Education, any except 5.
American Journal Mathematics, 1st five vols.
Annual of Scientific discovery, except from 1860 to 1871 inclusive.
Bees, works on desired.
Blackwood's magazine before 1865.
Botany, works on desired.
British Quarterly Review before 1865.
Bureau of Education, bulletins, 1871, Nov; 1872, March, April, June, July; 1873, No. 5; 1874, No. 2; 1882, No. 1.
Burnet's history of the reformation, part 1.
Chemical News, previous to vol. 15.
Chemistry, early works desired.
Coast Survey, 1858; any between 1872-80.
Contemporary Review, before vol. 34.
Edinburgh Review, between vols. 82 and 121.
Farmers' papers, early Michigan or other.
Fish commission, U. S., any except 1867, 1880, 1-2.
Forestry, 1st New York report.
“ works on, or reports are desired.
Fortnightly Review, before 1879.
French readers or literature.
Geology, works and reports on desired.
German readers or literature.
Journal Chemical Society, 1-2-3-4-5.
Journal Franklin Institute, previous to 1882.
London Quarterly Review, before 1865.
Magazine, American History, 1 to 8 inclusive.

MISCELLANEOUS—*Continued:*

Michigan Journal Education, after vol. 7.
" Teacher, after vol. 11.
Nation, vol. 1.
Nineteenth Century, before 1879.
North American Review, before 1820.
Official Records, War of Rebellion, vols. 3, 4, 5.
Pacific R. R. Survey, any after 10.
Price's Calculus, vol. 2.
School Readers, old Sanders, National, etc.
Signal Service U. S., 1874-5, annual reports.
Stephen's Pictorial History, War for Union, vol. 2.
Vermont Merino Sheep-Breeders' Register, vol. 1.
Veterinarian, before 1881.
Westminster Review, between vols. 12 and 83.
Young's Annals of Agriculture, vols. 39, 44, 45.
Zoology, any standard illustrated works on, in French, German or English.

M. J. CARPENTER,
Librarian.

Agricultural College, June 30, 1887.

REPORT OF THE PROFESSOR OF HORTICULTURE AND LANDSCAPE GARDENING.

To the President of the College:

The past year has been a prosperous one for the Horticultural department. The most important effort of this year, as of last year also, has been devoted to student labor. With the increase of the plantations of fruits and vegetables greater facilities are offered the student in search of a practical training in horticultural operations, and a higher grade of labor is open to all. With this increase of field equipment comes the question as to how much of the manual labor shall be made strictly educational with no remuneration.

It is evident, however, that such labor can never attain prominence until we are provided with more supervisors. The finer kinds of horticultural operations demand as great manual skill as do those of the shop or laboratory, while the work is of necessity so much scattered that nearly every separate gang should have an overseer. It is not expected that all labor shall ever be made educational. Such labor must always be limited by the number of overseers to direct it. I am gratified to know that you are in such hearty sympathy with advancement in this direction, and have such a keen appreciation of the requirements necessary to its attainment.

Few radical departures have been made from the established customs of the college in reference to student labor. The most important innovation, made by the unanimous consent of the State Board of Agriculture, was the paying of students by the quart instead of by the hour for picking berries. The students entered into the change with willingness, and it was in every way a success. A set of rules was printed and posted, a draft of which is submitted:

All berries are to be picked by the quart, the rate being two cents. Each picker shall take to the patch one and only one box-holder—the holder carrying four boxes—and shall promptly return the same to the packing house when the four boxes are filled. At the close of the day's work each student shall receive a ticket or tickets representing the number of quarts picked. As soon as a picker secures four one-quart tickets he is requested to exchange them for a four-quart ticket, and to exchange five four-quart tickets for one twenty-quart ticket. These tickets are to be presented at the secretary's office at the end of the term.

Pickers must observe the following rules:

1. All the ripe berries, and no green ones are to be picked.
2. Berries must not be crushed or mussed, and care should be exercised not to drop any on the ground.
3. Leaves or litter of any kind must not be allowed in the boxes.
4. Boxes must be rounding full when brought to the packing house.
5. Quantities less than a quart will not be counted in settlement.
6. Pickers must take one side of a row and pick it clean. No skipping from row to row or from plant to plant is allowed.
7. While picking strawberries, students must exercise care not to step on the plants. They must not stand on their knees.
8. So far as possible, the berries must be placed in the shade as soon as a box is filled.

In class-room instruction very little change or improvement in methods has been attempted, from the fact that there are no facilities at command for such improvement. When the projected horticultural building is completed it is expected that many new and more satisfactory methods of teaching can be inaugurated. Already there has been some attempt at laboratory work, and each student in the class in horticulture has been obliged to take practice in budding, making of cuttings of various sorts, sowing seeds under glass, pricking out, transplanting, repotting, stratification of seeds, etc.

Crops in the garden and orchards have been good as a whole, notwithstanding the extreme drouth which prevailed during most of the growing season. The crops of strawberries, pears and apples, especially, have been good.

Although there is no time or means provided for the conducting of experiments, yet some investigations have been carried on as time would permit. The mere growing of so many kinds of plants for illustration consumes much time and thought, and great vigilance has to be exercised in keeping kinds distinct. Duplicates of many plants are sent to fruit growers about the State, the growers being selected with reference to their ability and facilities for carrying out accurate tests of varieties. I submit herewith notes upon a portion of the experiment work of the year, with supplementary notes, in some cases, from the investigations of others. In this work, as in all else connected with the department, I am under obligations to the painstaking work of my foreman, Mr. C. S. Crandall.

WORK OF EXPERIMENT AND OBSERVATION.

I. Notes on Tomatoes.
II. Notes on Peppers.
III. Notes on Onions.

IV. Notes on Strawberries.
V. Lists of Fruit and Ornamental Plants Growing at the College.
VI. Calendar of Trees and Shrubs.
VII. Influence of Certain Chemicals upon Germination.
VIII. An Experiment in Apple Culture.
IX. Miscellaneous Notes:
    1. Bud Variations.
    2. Brief Potato Notes.
    3. Notes on Crossing and Hybridizing.
    4. Which Flower in the Cluster Makes the Apple?
    5. Why are Young Trees Barren?
    6. Germination of Seeds which have been kept on Ice.
    7. Growth of Plants from Soaked Seeds which have been Dried.
    8. What do we get in Lawn-grass Seed?
    9. Trees as Shrubs.
    10. Effects of last Winter.
    11. "Water-proof Fibre" Cloth for Cold Frames.

I. NOTES ON TOMATOES.—The experiment with tomatoes which was inaugurated last year has been carried forward this year upon a much larger scale. All the named varieties offered by American seedsmen were grown, and also all those offered by three leading European seedsmen, F. & A. Dickson & Sons, Chester, England; Vilmorin, Andrieux et Cie, Paris, France; Robert Neuman, Erfurt, Prussia. About a dozen plants of each sort were grown. The varieties were arranged consecutively after the classification proposed in my tomato bulletin of last year,* each sort being designated by a number. The plants covered an acre of ground, and comprised 170 numbers. There were not one hundred and seventy named varieties represented, however, as many varieties were duplicated from different countries and various seedsmen. One hundred and ten so-called varieties were grown, not counting those French and German names which are simple equivalents to English names. Seventy-five named sorts were grown last year. A complete collection of egg-plants and strawberry tomatoes (*Physalis*) were also grown.

These numerous varieties of tomatoes are not grown for curiosity, nor for the simple purpose of securing a collection of all the known sorts. It has seemed to me worth while to inaugurate an extensive and careful experiment upon this invaluable fruit, and for several reasons. The varieties of tomatoes are now so numerous, their nomenclature so much confused, and their individual merits so uniformly praised, that the cultivator is perplexed.

There is reason to believe, also, that the limit of improvement of varieties is not yet reached. In order to throw light upon these points, and to make a proper beginning for the breeding of varieties, it is essential that all known varieties should be grown before the eyes of the experimenter. There is the same reason for this proceeding as there is for the mastering of the literature of any subject prior to the actual research upon that subject. There is a too common tendency on the part of experimenters to begin investigations without proper preparation. Two years' experience with many varieties of tomatoes has enabled us to understand somewhat of the laws and direction of variation in this plant, and to become acquainted with the best sorts now grown. We are now ready to make an intelligent beginning in the crossing and general breeding of varieties. We find, and in the case of other plants as well, that the first year's experiment is chiefly valuable in giving the investigator a general idea of the varieties he grows and in suggesting to him the relationships which can be used in classification and characterization. A classification once made, even though it be not the best, the investigator can facilitate his work by arranging his plants in the field upon its system.

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*Notes on Tomatoes, Bulletin No. 19, issued September 30, 1886.

Synonymy.—The determination of the duplicates among the many so-called varieties of tomatoes is one of the most obviously practical problems connected with this experiment, and one which has received much attention. There is probably no garden plant which is so difficult to study in this respect as the tomato, from the fact that varieties are characterized almost entirely by the color, size, and shape of a fruit which is of all others the most variable. Moreover, the tomato has been in general cultivation so short a time that varieties are not yet fixed. Add to these facts the hasty and bungling methods or lack of method of seedsmen and others in securing the so-called new varieties, the wide variations of the same varieties on different soils and under different managements and the frequent mixing of stocks by careless parties, and the task of determining duplicates appears to be almost hopeless. But the very difficulty of the task is all the more reason why it should be grasped. This whole matter of determining the synonymy or the duplicates in cultivated plants, together with the reformation of garden nomenclature, is exceedingly important. None are so well qualified to undertake this work as many of our seedsmen and it seems strange that they should be the very ones who make the work necessary. The time can certainly not be far distant when the most popular seedsmen will be those who exercise the most care in excluding "novelties" and unnecessary varieties.

As an example of the manner in which names are sometimes employed and transferred by seedsmen, I cite two cases: The "Large Red Smooth Round" is often, at least, a "trade name" used to sell the odds and ends of all varieties which are large, red, smooth, and round. A certain firm, wishing to have a tomato of a certain name, which did not exist in the catalogue, had packets printed with the new name, and filled the packets with seeds of a well known variety. In many cases it is almost impossible to detect such a transfer, on account of the great variableness of the tomato. The same variety from different sources often varies as much as different varieties from the same source. Most of the duplication of varieties, however, is ingenuous. Sorts which appear to be different one year or in one place may appear to be exactly the same in other years or places. Again, the distinctions are often so very slight and subtle and withal so inconstant, that they are very difficult of determination. A certain strain may differ from others in some minor character, which soon disappears. It is utterly impossible to distinguish many of the market varieties solely from written descriptions, and one can never be sure that all his varieties are true to name. Furthermore, he does not know their history, as to whether they are mere selections from the best plants of a given variety, or whether they are of entirely independent origin and are in the process of improving or degenerating. Again, to be sure of the identity or distinction of some sorts, the grower must raise them in considerable quantity. A dozen plants cannot be expected to show, in all cases, the relative constancy of characters. I have distinguished varieties and kept them separate whenever possible, but whenever varieties are so near alike that I can determine no character of even ordinary constancy, they are thrown together under the oldest unobjectionable name. Even though some of these relegated varieties may possess prominent marks in some cases they will, in the main, be found to so closely resemble the variety with which they are placed that the cultivator will find no superior quality in them. It would be gratifying to know, however, that seedsmen could turn their attention somewhat in the direction of the elucidation of synonomy rather than in the entanglement of it.

Yet, notwithstanding the apparent importance of determining synonyms or duplicates, there are other far more important features of this study of varieties of garden plants. We need to determine the general characteristics and tendencies of the existing varieties. as indicated above, in order to make any safe venture towards improvement. Again, this system of comparing varieties, of sorting, emphasizes the good and bad qualities of each variety, and at once establishes a standard of excellence. To sort out varieties is more important than to sort the fruit for shipment, for its value, influence, extends over many seasons. Thus it becomes apparent that even if the determination of duplicates, as recorded in the following pages, is not always correct, there is yet a broad and deep value in this system of comparison. If the expert gardener is not able to indorse this disposition of varieties, he can nevertheless obtain good from it. The expert gardener may even be able to find just the particular strain he wants from the subordination of names, for exceedingly like sorts are thrown together. He can pick from a few better than from many.

*Direction of Variation.**—The Cherry tomato is undoubtedly the original tomato, from which have come all the varieties of our garden, with the exception of the currant, which represents a distinct species. One of the first variations from the primitive type is the augmentation of cells in the fruit, followed by a tendency to irregularity in shape. Later, the flowers become monstrous by the production of an abnormal number of parts. In the synopsis of varieties on a succeeding page, the varieties are arranged in the order of their supposed development, so far as possible in a lineal classification. The true development of the leading sorts is better represented in the following diagram, on page 69.

The figures in the succeeding pages illustrate some of the leading types of tomatoes, and show some of the most striking points of departure from the first type. Fig. 4 illustrates the ordinary tomato foliage, although this is a variation from the smaller and thinner foliage of the Cherry sorts. Fig 5 illustrates the peculiar "curled" foliage of many of the angular sorts. Figs. 9 and 10 show the very singular foliage of the Mikado, Potato Leaf, and Nisbit's Victoria. Fig. 11 represents the habit and foliage of the Grenier or French Upright. Figs. 2, 3, 6, 7 and 8 illustrate variations in fruits. The general habit of plants also varies much.

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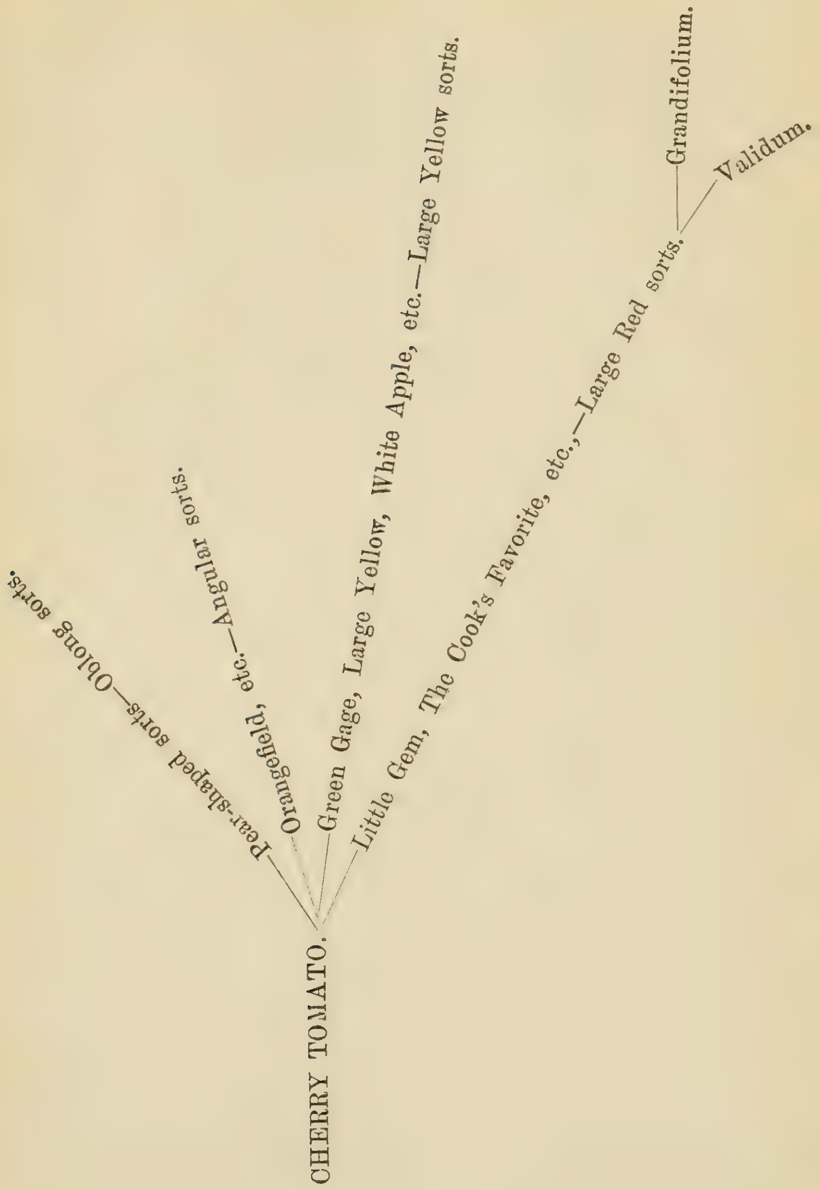
* For a fuller discussion of this subject the reader is referred to an illustrated article by the writer in American Naturalist, June, 1887, 573.


CHERRY TOMATO.
Pear-shaped sorts—Oblong sorts.
Orangefield, etc.—Angular sorts.
Green Gage, Large Yellow, White Apple, etc.—Large Yellow sorts.
Little Gem, The Cook's Favorite, etc.,—Large Red sorts.
Grandifolium.
Validum.

The variation in seed production is an interesting and important one. In order to determine something of this variation a pound of fruit was taken from several varieties and the seeds carefully counted. The results are shown in the table:

Variety.	No. of fruits in the pound.	No. of seeds in the pound.	Average No. of seeds in a fruit.	Where the Variety was Obtained.
Red Cherry	101	7,312	72 2-5	Agricultural College (*Henderson*).
Kirsch rothe	68	4,830	71 1-3	Prussia.
King Humbert	7	645	92 1-7	Agricultural College (*Rawson*).
King Humbert	7¼	703	97	Prussia.
Criterion	7	1,095	156 3-7	Agricultural College (*Gregory*).
Conqueror	6	1,215	202 1-2	England.
Large Red	7	1,754	250 4-7	England.
Franz gross rothe	5	1,480	296	Prussia.
Hubbard's Curled Leaf	7	1,310	187 1-7	Agricultural College (*Nellis*).
Rouge grosse hetive	8	1,608	201	France.
Tom Thumb	8	1,502	187 3-4	Agricultural College (*Rawson*).
Improved Large Yellow	13	2,250	173	Agricultural College (*Thorburn*).
Persian	5	1,398	279 3-5	Agricultural College (*Nellis*).
The Cook's Favorite	10	1,457	145 7-10	Prussia.
Boston Market	6	1,106	184 1-3	Agricultural College (*Rawson*).
Fulton Market	6	1,441	240 1-6	Agricultural College (*Gregory*).
N. Y. Market	6	925	154 1-6	Agricultural College (*Nellis*).
Trophy	5	886	177 1-5	England.
Trophy	5	702	140 2-5	England.
Trophy	6	1,450	241 2-3	Prussia.
Cardinal	4	941	235 1-4	Thorburn, N. Y.
Livingston's Favorite	6	1,166	194 1-3	England.
New Red Apple	5	1,365	273	Agricultural College (*Gregory*).
Tilden	10	1,696	169 3-5	Agricultural College (*Gregory*).
Paragon	4	763	190 3-4	Agricultural College (*Henderson*).
Paragon	4	1,180	295	Prussia.
Emery	4	781	195 1-4	Agricultural College (*Rawson*).
Acme	5	1,256	251 1-5	Prussia.
Mikado	2	435	217 1-2	Agricutural College (*Henderson*).
French Upright	5	583	116 3-5	Agricultural College (*Thorburn*).

A careful study of this table reveals, among other important matters, the fact that seed production does not keep pace with increase in weight of fruit, and that seed production bears no constant ratio to degree of development of fruit. To illustrate the first point, it is but necessary to cite a comparison of the Red Cherry and Paragon, for while the average Paragon fruit is over twenty-four times heavier than the Red Cherry, its seed production is but two and a half to four times greater. The very wide variations in the average numbers of seeds to a fruit, as indicated in the third column of figures, is proof of the second point, *i. e.*, that seed production bears no constant ratio to the degree of development of fruit.

It was observed that the seeds from Prussia germinated sooner than those of American growth. This is, no doubt, due to the fact that tomatoes are largely eaten in Germany in a green condition and that seeds are probably saved from green fruits. It is well known that seeds from unripe fruits germinate sooner than do those from ripe fruits. The percentages of germination are low in the German seeds. These facts do not always appear prominently in the synoptical table, as some seeds received from Prussia were not grown there.

Training.—The culture of the tomato, being for the most part well understood, is not a leading feature in this experiment. However, attention has been given to the best methods. The area in plants was so large this year that no training was given. The plants were allowed to fall upon the ground freely. In a market patch leafless brush was laid alongside the plants and it furnished a considerable support. I am inclined to regard it as desirable in clean ground. The remainder of this paragraph is taken from the tomato bulletin issued last year. Three methods of training were employed this year, and another method last year. All the experimental tomatoes were tied to one, two, or three stakes about four feet high. This method has many disadvantages. It requires much labor to tie the plants, a labor which must be repeated at short intervals throughout the growing season. The tomatoes do not ripen evenly and early and it requires extraordinary time and labor to pick them from the dense mass of stems and foliage. Although the outlay for the stakes is small, this method of training is still the most expensive of the four. Last year we laid old boards lengthwise the rows and close to the plants, supporting them upon pieces of scantling or blocks laid upon the ground, and placed straw upon the boards. This method kept the tomatoes clean, but it appeared to increase the rot. It certainly caused the lower ripe tomatoes to rot prematurely. In our market patch this year we adopted two sorts of racks. The first was a separate rack for each plant. A stake was driven on either side of the plant, about fifteen inches from it, and leaning so as to make an angle of about twenty degrees with the perpendicular. Upon these stakes three cross-slats were nailed, in the manner of a ladder. The plant was allowed to lop upon the racks. It was found necessary to tie it, however, and even then branches slipped off or broke themselves over the slats. The second of these racks was continuous throughout the row. About every six or eight feet a stout stake was driven on either side of the row and fifteen inches from the plant, the stakes when firmly driven standing some over a foot high. A strip of old boards was nailed near the tops of the posts along either side of the row. Then edgings were tacked across from one side to the other, four about each plant and a foot apart. The plant now found itself growing up between the horizontal edgings, and as it began to lop the rack held it above the ground. Upon this simple rack the tomatoes needed no tying nor training and they spread themselves freely to the sunlight. The circulation of the air under the racks was so free that there was no unusual danger from rot. This is decidedly the best rack which we have tried. We noticed, also, that the fruit ripened more uniformly here than on the plants which were tied to stakes.

Tomato Rot.—This disease, which works such sad havoc in the tomato patch, has not yet been thoroughly studied by plant pathologists. It first appears as a slight spotty discoloration about the apex of the tomato, gradually extending and becoming darker until the whole top of the fruit sinks in. The disease attacks the fruits at any time after they are a third or quarter grown. It threatens to become a serious obstacle to tomato growing. It is commonly supposed that in such dry years as the present rots are not prevalent. Tomato rot is, of course, of fungous origin. The miscoscope reveals abundance of bacteria and the mycelium of some higher fungus, as well as occasional isolated septate spores. Professor Arthur* has made numerous inoculations from cultures of the bacteria but has not produced the rot. Hence he concludes that some higher fungus produces the disease. As yet we know of no remedy or preventive. The first preventive which suggests itself is to plant varieties which are least liable to attack. E. S. Goff † is of the opinion that the fruits on the most vigorous plants are most liable. Such has not been our observation. We occasionally observe plants in no way distinguishable from others, which are nearly exempt, while all the contiguous plants are much affected. As there is no reason to suppose that the disease is conveyed in the seeds, it would seem that its appearance is accidental. It is singular that the angular varieties (see Synopsis), the cherry and pear-shaped varieties and those immediately derived from them, have been almost exempt from attack. The disease ceased to do much damage late in the season.

Abundant use of stable manure appears to augment the disease. The worst cases of rot this year occurred upon plants grown upon a freshly turned sod which had been previously dressed with manure, on sandy land. Our market and experimental patches were grown upon land which had not been cropped with tomatoes for years, if, indeed, it had ever been so cropped, yet the rot was as bad as upon a row of plants grown purposely upon the site of our last year's experimental plat and where the rot was very abundant. This agrees with a similar experiment conducted by Professor Arthur.‡

Productiveness.—One representative plant of each variety was selected for particular observation. The fruits were picked and weighed as fast as they matured. September 24, when the plants had been killed by frost, all the remaining fruit, ripe and green, was picked, counted, and weighed, and the plant itself was then weighed. The Synoptical Table records these results, as well as the aggregate number and weight of fruits, the average weight of a single fruit, and the ratio of weight of crop to weight of plant. Although these results show the characteristics of individual plants rather than of varieties, they are nevertheless interesting and valuable. A careful study of the table will afford much instruction upon productiveness, earliness, etc. The most prolific variety—the one which shows the greatest ratio of fruit to weight of plant—is not always the most profitable, even when earliness and quality are not to be considered; that is, the plant itself must not be too large, else the cost of training it will be too great. The lowest plant is usually the most profitable.

Some of the best ratios of productiveness—of weight of fruit to weight of plants—occur in the Cherry and similar tomatoes which are entirely unprofitable on account of the small size of the individual fruits. It appears, there-

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*Rep. N. Y. Exp. Sta., iii., 379.
† Rep. N. Y. Exp. Sta., iv., 183.
‡ Rep. N. Y. Exp. Sta., iv., 250.

fore, that cultivation has not increased productiveness equally with size of fruit. Neither has it made earlier plants, for, as shown by the table, the Cherry and Plum sorts are still our earliest varieties. Cultivation has made the tomato profitable by increasing the size of the fruit and by making it more solid. Cultivation has bred away from profitable results as concerns the relations of tomato rot to the various varieties. The more highly developed tomatoes are most liable, apparently, to be attacked by rot. In view of all these facts, it is apparent that we have not yet reached the limit of development, improvement in the tomato.

For purposes of comparison, I have appended to the table a table made last year, showing the weight of fruit and plant, and the ratio of the former to the plant. The weights in these cases were obtained by weighing all the fruit at once, ripe and green, as soon as the first picking was well matured, and the plant was weighed at the same time. In this table the weights are in pounds, while in the first they are expressed in ounces. Last year the highest ratios of productiveness occurred in Mikado, Trophy, Canada Victor, Hundred Days, Precursor, and Livingston's Beauty. It will be observed that the ratios are higher this year than they were last. This is due to the fact that last year the plants were grown upon a very rich and warm soil, which made an enormous growth of vines, while this year they were grown upon a rather backward soil without manure. Our crop was heavier this year than last and easier to gather.

Best Varieties.—Taken altogether, we find that, this year, the best market sorts are Acme (No. 57 in Synopsis), Paragon (50), Queen (44), Puritan (53), Optimus (51), Red Valencia Cluster (45), Potato Leaf (58), Mikado (59), and Yellow Jefferson (33). Jackson (21) and Ignotum (52) also promise well, but need to be further tested. In fact, Ignotum was this year our best tomato.

Cyphomandra.—The so-called Tree Tomato of Jamaica was reared from seeds last year and two plants were carried over winter in the greenhouse. They were potted out in the spring. They grew well, attaining a height of eight feet. They blossomed profusely during the fall, but did not set fruit. We shall carry them over another year. This curious plant is a native of tropical America, a member of the Solanum family, though not a tomato. It is Cyphomandra betacea. It has been widely distributed through the tropics of late years. The fruit more nearly resembles an egg-plant fruit than a tomato. We have also grown it this year from seeds from Peru which were sent us as the "Chileno Tomato." Of course the plant is valueless in this climate.

SYNOPSIS OF CULTIVATED TOMATOES.

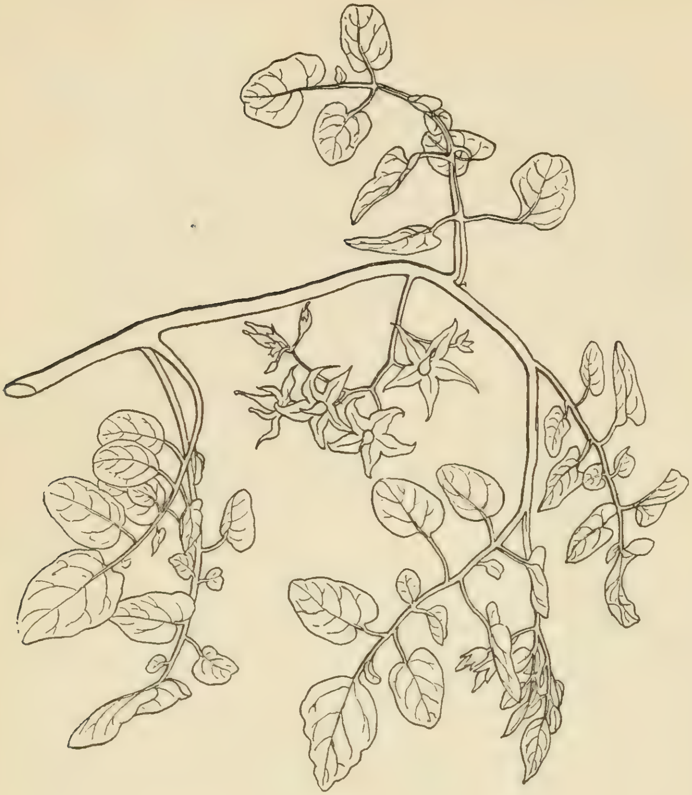

FIG. 1.

I. LYCOPERSICUM PIMPINELLIFOLIUM Dunal, Solan. Syn. 3 (1816). *Solanum pimpinellifolium* Linn. Sp. Pl. Ed. ii. 265. *Solanum racemigerum* Vilmorin. *Lycopersicum racemosum* of gardens. *Solanum raceniflorum* Vilmorin, Pl. Pot. 560, not Dunal. Leaflets round-ovate, obtuse, entire ; plants, more slender and more diffuse than in L. esculentum.

1. *Currant*, Fig. 1. (*Rothe Johannisbeerfruchten.*) This a native of Peru and Brazil. It has probably not been long in cultivation. It is evidently the Grape or Cluster tomato of Burr's "Vegetables of America," 1863. The species has not yet been modified by domestication. The fruits are clear, bright red, somewhat larger than a very large currant, and are borne in long, two-ranked clusters. The plant is very ornamental. If trained upon a trellis, near a window, it would make one of the most attractive screens. The whole aspect of the plant is delicate. College from Thorburn, Prussia.

II. LYCOPERSICUM ESCULENTUM Miller, Gard. Dict. (1768). *Solanum Lycopersicum* Linn. Sp. Pl. ed. i. 150 (1753). *Lycopersicum cerasiforme* Dunal, Hist. Sol. 113 (1813). *L. pyriforme* Dunal, l. c. 112. *L. esculentum* var. *cerasiforme* Gray, Bot. Cal. i. 538; Syn. Fl. N. Amer. ii. part i. 226. Leaflets ovate-acuminate or lance-ovate, variously cut and parted.

This, the ordinary tomato, is a native of Peru. The original wild type is the form designated by botanists as *Lycopersicum cerasiforme*, "cherry tomato" of the gardens. The Cherry tomato is still known in a wild state in South America, and it is either indigenous or spontaneous as far north as the lower border of Texas. It is distinguished from the ordinary market tomatoes by its weaker growth and its small, regular, spherical, two-celled fruit. It appears to have been early cultivated in Peru, there developing into some form of the common tomato. The first effect of domestication appears to have been the increasing of the number of cells in the fruit. This increase of cells is due in part to the doubling of the flowers by cultivation, and in part to the growth of adventitious cells after the fruit is partly grown. In some of the large irregular tomatoes I find as many as twenty cells. The dark "ring" which appears on the top of overgrown tomatoes marks a rupture, very gradual to be sure, of the cell divisions by the interposition, the forcing-in of new cells. These more or less developed new cells are often indicated by the excrescences within the "ring." They are very conspicuous in the singular Turk's Cap variety, Fig. 7. The pear-shaped tomatoes, heretofore called *Lycopersicum pyriforme*, are evidently only cultural sports from either the original Cherry tomato or its garden offspring. The pear-shaped and the larger garden tomatoes are unknown in a wild state. The tomato was grown in Europe in 1561,* and probably earlier. In 1583 the fruit was eaten upon the continent "dressed with pepper, salt and oil." † English authors speak of it in 1597‡ and 1656 §, but mention it as grown for curiosity only. In 1752 Miller** records its use in England for flavoring soups. In 1819 †† four red varieties were grown in Europe: Large Love Apple or Tomate grosse, Small Love Apple or Tomate petite, Pear-shaped Love Apple or Tomate en poire, and the Cherry Love Apple or Tomate cerise. There were two yellow varieties: Large Yellow Love Apple and Cherry Yellow Love Apple or Tomate petite jaune. As early as 1623 ‡‡ four sorts were known, the yellow, golden, red, and white. The white variety was even known to Besler in 1613.§§ Tournefort,*** 1700, mentions seven sorts, among them one which was pale red. At the beginning of the nineteenth century three of these old varieties were unknown, the white, golden and pale red. As these are now present in our gardens, we must suppose that they have been re-originated. The cultivation of the tomato for market dates from about 1800 in England and about 1830 in this country. In 1847 **** three varieties were grown for the table in the United States, the Large Red, Large Smooth Red, and the Pear-shaped. The Cherry tomato appears to have been grown as a curiosity. During the last twenty-five years a perplexing catalogue of new varieties has been presented. Many of the varietal names current a few years ago have become extinct, although it is probable that most of the varieties which they represented are still grown under other names. The following are some of the old names which do not appear in catalogues this year and which we have not been able to secure: Giant Apple, Improved Apple, Large Red Oval Fruited, Mexican, Round Yellow, Seedless, White's Extra Early, Funchal, Early York, Maupay's Superior, Mammoth Chihuahua, Foard, Eureka, Chorlton's Prolific, Sim's Early Cluster, Grape Shot, Howard, Lyman's Mammoth Cluster, New Japanese, Painted, Powell's, Red Chief, Triumph, Jones's Early Hybrid, Standard Market, and Shipping.

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* Anguillaria, Simp., 217.
† Dodonæi Stirp. Hist, 455.
‡ Gerarde, Herballe, 275.
§ Parkinson, Paradisus.
** Gardener's Dict.
†† Hort. Trans. Lond. iii., 347.
‡‡ Caspar Bauhin, Pinax, 167.
§§ Hortus Eystitensis.
*** Inst. Rei Herb. i., 150.
**** Buist's Family Kitchen Gardener, 126.

A. CERASIFORME.—Cherry tomatoes. Plant weak, requiring support if held from the ground; leaves ordinary; fruit small, (usually about ½ in. in diameter), spherical, regular and two-celled.—*Lycopersicum cerasiforme* Dunal.

2. *Red Cherry.* Desirable for pickles and preserves. The *Kirsch rothe* from Prussia gave us larger fruits than the plants from American seeds, the fruits often measuring over an inch in diameter. *Cerise,* from France, also averaged somewhat larger and exhibited a greater tendency to become irregular. That is, in the Old World, where these small sorts are more popular than with us, the Red Cherry appears to have developed away from its first form somewhat.—College from Henderson, Prussia, France.*

3. *Yellow Cherry.* Like the last except in color. *Gelbe Kirsch* from Prussia averages twice larger than fruits from American seeds, and the fruits have a greater tendency to become irregular. —College from Thorburn, Prussia.

B. PYRIFORME.—Pear and Plum tomatoes. Plant nearly as in section A. (No. 5 has the foliage of section D); fruit more or less pear-shaped, conspicuously pendant, two-celled. *Lycopersicum pyriforme* Dunal.

Attractive varieties, peculiar in shape, excellent for preserves, pickles, etc.

4. *Pear.* (*Queen of Tomatoes* of Dickson, *Poire,* of Vilmorin, *Pear* of Ferry and some others, but not of Henderson and some other seedsmen.) Fruit 1½ inches or less long, red, very much contracted at the base. Fig. 2. —England, France.

5. *Nisbit's Victoria.* Fruit almost identical with the last, but the leaves large and leaflets few, as in the Mikado. An English variety, said to have been grown from seeds of the Hathaway, but this statement needs verification. College from Nellis, England.

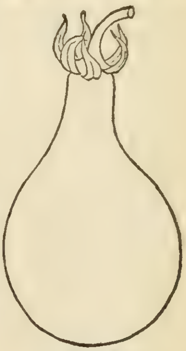

FIG. 2

6. *Fig.* (*Wonder of Italy. Rothe Birn*). Much larger than the

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* The expressions, "College from Henderson," "College from Thorburn," etc., are meant to record the fact that the seeds came from the seedsmen named last year (1886) and that the seed for this year was grown from that stock in the college garden. Such expressions as "College from Henderson and Thorburn" indicate that the seed was secured last year from both the seedsmen named.

last, 2 inches long by 1½ inches broad at the top, variable in shape, but usually obscurely pear shaped, very firm, red. Fig. 3. Figured and described in Burr's Vegetables of America, 634.—Burpee, Prussia.

7. *Red Plum.* (*Pear* of Henderson and others, and the *Pear-shaped* of our last report.) Fruit 1½ to 2 inches long, scarcely pear-shaped, tending rather towards the shape of an oblong plum, bright red. This fruit should never pass as a pear tomato.—College from Henderson.

8. *Yellow Plum.* Like the last except in color.—College from Henderson.

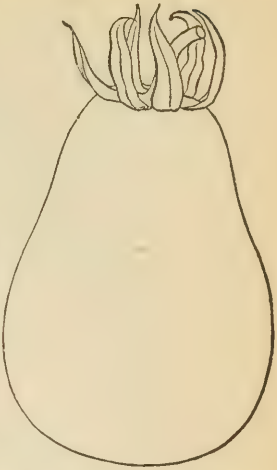

FIG. 3.

C. VULGARE.—Common market tomatoes. Plant as in sections A and B, except usually more vigorous, the foliage coarser; fruit commonly as broad as long or broader, usually more than two celled. Many of the varieties of this section are direct developments from the Cherry and Plum varieties, and in some cases are scarcely distinguishable from them except in size. It is thought best, however, to keep sections Cerasiforme and Pyriforme apart from this, as they represent the nearest approach to the original wild tomato.

Group 1. The Oblong Tomatoes. Fruit usually as long or longer than broad, the walls very thick and firm, the placentæ usually not meeting the inside of the wall, causing the fruit to feel as if hollow.

9. *King Humbert.* Fruit two and a half to three inches deep, by an inch or inch and a half broad, fig-shaped, regular, or nearly so; bright red, not ripening simultaneously on the stem end, two or three celled, scarcely acid. A short remove from the Fig tomato. One of the best tomatoes for pickles and preserves. A European variety, introduced by the Rural New Yorker, and figured in that journal Nov. 8, 1884. In its small and regular forms it is very much like the Fig. The *Trentham Fillbasket,* from England, was mixed, some of the plants bearing fruits like the King Humbert. I am not informed as to which plants the name should apply.—College from Rawson, England, France, (fruits smaller) Prussia. (The seeds from Prussia were grown in France.)

10. *Criterion.* (*Vick's Criterion.*) Average fruits two to two and a half inches deep, and two inches broad, obscurely angled, more or less squared at the ends, pink-purple, commonly, two or three celled. Occasionally, by the interposition of adventitious cells, the fruit broadens, becoming three times broader than deep. Such fruits, growing on the same plant with those which are almost pear-shaped, illustrate the process through which our garden tomatoes have been developed from the wild type.—College from Gregory and Henderson, England.

Group 2. The Angular Tomatoes. Fruit medium or below in size, mostly very flat, plane on top, more or less cornered, the lobes most conspicuous on the bottom and sides, red. This is the type of the original Large Red, the first market tomato. The type is almost lost in many of our later improvements, and it is now too inconstant, perhaps, to be relied upon as a sectional character. In all characters used in distinguishing cultural varieties, however, one must rely only upon the average of many observations. The old Large Red was mostly dropped from cultivation some fifteen or sixteen years ago. We have grown it this year from English seeds. In 1818* tomatoes in England averaged about twenty pounds of fruit to the plant, some

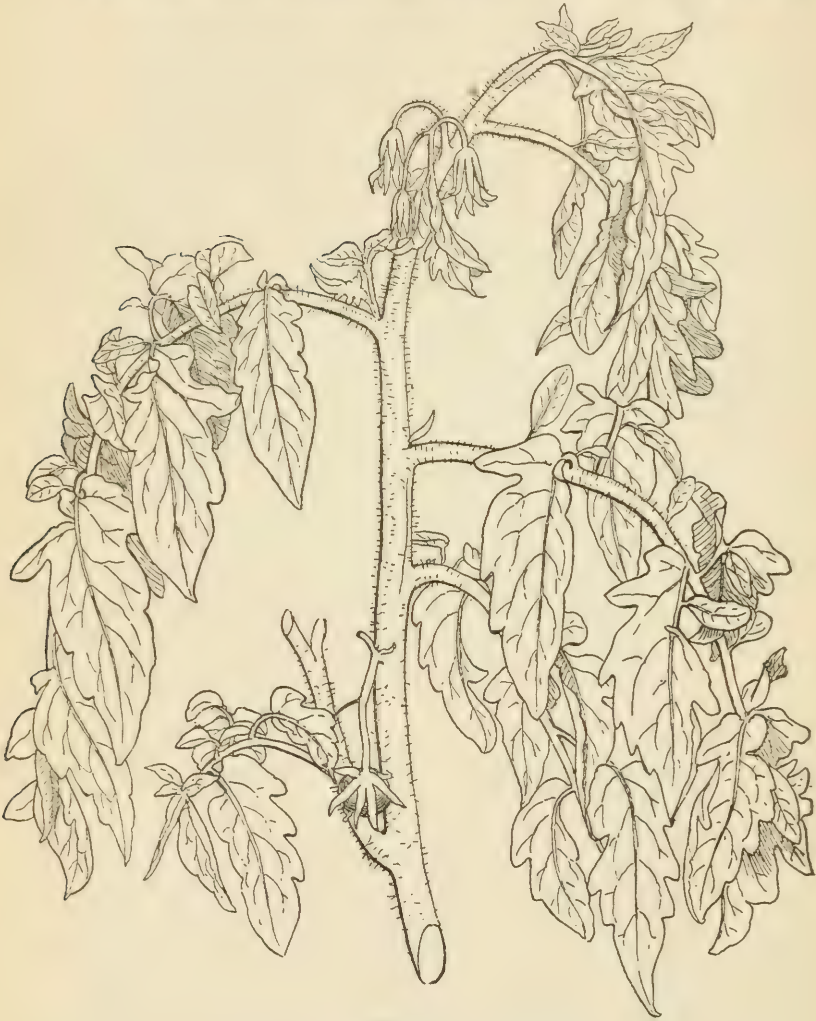

FIG. 4.

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* Hort. Trans. Lond., III., 346.

plants producing as high as forty pounds. The largest fruits somewhat exceeded twelve inches in circumference and weighed twelve ounces. These were probably the Large Red variety. Aside from the Cherry and Plum tomatoes, the fruits of this group are among the very earliest of tomatoes. The group is peculiar in the dwarf habit of the plants and in the tendency of the leaves to " curl " or roll up on the edges. This rolling of the foliage gives the plant a singular, wilted appearance. Fig. 5, the foliage of Tom Thumb, shows this character. It should be studied in connection with Fig. 4, which represents the foliage of the Paragon. The degree of the " curl " is mostly characteristic of the variety in this group, and I have therefore made some use of it in the classification which follows. The peculiar angular character of the typical fruits of this group is well illustrated in Fig. 6, the Early Dwarf Red. This illustration should be compared with that of the Paragon, Fig. 8.

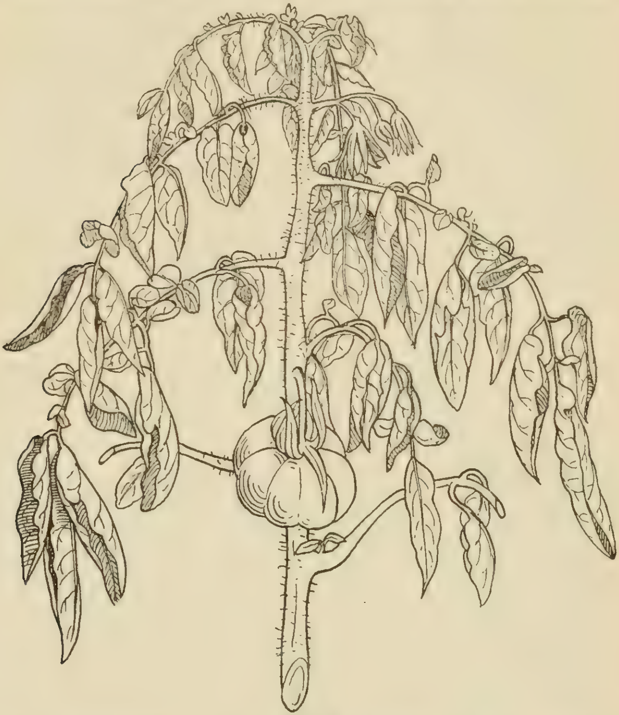

FIG. 5.

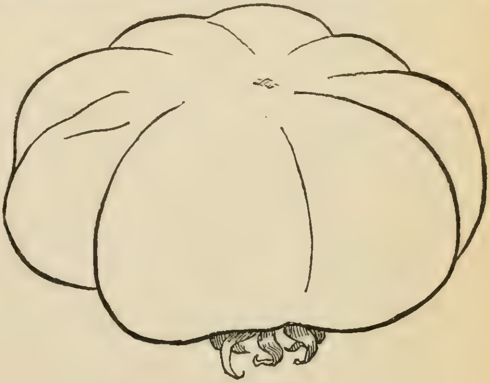

FIG. 6.

* *Leaflets plane or nearly so; i. e.*, not conspicuously "curled."

11. Orangefield. (*Dwarf Orangefield. Orangefield Dwarf Prolific.*) Plant medium in size and growth: fruit small, scarcely angled, nearly as long as broad (about one and a half inches deep in ordinary specimens), yellowish-red, rather soft, often two-celled. —Evidently a short remove from the Red Cherry, rather than from the Large Red. Said to be of English origin. Not desirable. At the Chiswick (England) test it was found that in the Orangefield "the fruits are very large and corrugated or ribbed." That variety was surely not ours. It was said to be identical with the Large Red Italian. This year the fruits were much less angled than last year, although the plants were grown from seeds of the last year's fruit. There is an evident reversion to the Cherry tomato. Suggests No. 30.—College from Sibley.

12. *Eiformige Dauer.* A pretty variety, uniform in size and shape, average specimens measuring nearly or quite two inches across, conspicuously angled, often nearly square; firm; very bright orange-red. Looks as the Orangefield did last year. (See No. 52.)—Prussia.

13. *Hundred Days.* (*Hundert Tagige.*) Fruit two to three inches across and usually less than an inch and a half deep, mostly much angled, dark red. The *Stamfordian* from Dickson, England, appeared to be the same.—College from Thorburn, Prussia.

14. *Cedar Hill.* Much like the last, but averaging larger.—Prussia.

15. *Conqueror.* Fruit large for this group (often four inches or more broad), oblong, bright dark red and densely sprinkled, especially below, with very small golden yellow dots. Said to be a cross between the General Grant and the Keyes. Introduced in 1874. The dense sprinkling of golden dots is not present in most of the recent strains of this variety. With us this year it showed most in fruits raised from English seeds, and least on those raised from Prussian seeds. The stocks of this variety are apparently much mixed. The fruit is variable and irregular. It is valuable only for its earliness, and should now be displaced by better sorts.—College from Henderson, Prussia, England.

16. *Large Red.* Fruit two to four inches across, very conspicuously angled and cornered, tending to bend downwards at the ends and become "ringed" on top. More cornered than Conqueror and averaging larger. This is evidently the same as the original Large Red. It is still a good tomato.—England.

    The *Rouge grosse* ("Large Red") of Vilmorin is larger than this, usually more sharply angled, and lighter colored, later. It is much the same as Jackson, but is lighter and somewhat firmer. It is a very fine strain. *Franz gross rothe* of Neumann is evidently the same as the English Large Red above.

17. *Early Richmond.* Scarcely distinguishable from Large Red, except that it was somewhat earlier this year.—Landreth.

18. *Bermuda* (*Bermuda Extra Early*). Like the last and Large Red, only that it was later than either.—Landreth.
19. *Precursor*. Much less cornered than the Large Red or Conqueror, without any sprinkling of golden yellow spots. As compared with Tom Thumb, the fruit averages a little larger and darker colored.—College from Nellis.
20. *Cluster*. (*Extra Early*). Scarcely differs from the last, except in its earliness.—Landreth.
21. *Jackson*. (*Jackson's Favorite*). Larger than the Large Red, the surface, especially beneath, usually covered with minute golden dots. Larger and more uniform and better in shape than the Conqueror. A good variety.—England.
22. *Turk's Cap*. (*Turkenbund*). Plants producing many slender, upright shoots; fruit one and one-half to two inches across, nearly spherical, crowned by a singular, irregular mass of protruded, fleshy cells. Fig. 7. Valuable only as a curiosity.—Prussia.

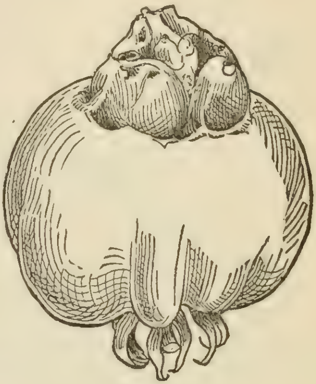

Fig 7.

** *Leaflets much involute* or "curled."

23. *Early Dwarf Red*. (*Rouge naine hative. Frühe rothe zwerg.*) Normal fruits about two inches across by one inch deep, dark orange red, conspicuously angled or even cornered.—England, France, Prussia, the Prussian specimens being earlier.
24. *Hubbard's Curled Leaf*. (*Krausblätter. Rouge grosse hative.*) Fruit somewhat larger than that of the last, not so conspicuously squared. As compared with Tom Thumb, the plant is larger, leaflets less curled, fruit more variable in size and shape and approaching more nearly the character of the apple-shaped sorts.—College from Nellis, Prussia, France.
25. *Keyes*. (*Keyes' Early Prolific.*) Fruit rather small, about two inches across by one inch deep, the angles few and large and giving the fruit a regular and even shape peculiar in this group. Leaflets much curled, larger than in most of the group. An old sort.—Prussia.
26. *Tom Thumb*. Plant small, two to two and a half feet high when tied; leaflets very much curled, so that the upper surface is often nearly hidden; fruit early, the larger specimens from two to three inches across, usually less than an inch and a half deep, mostly much angled, clear light red, firm and meaty. A pretty sort, strongly resembling Hundred Days.
27. *Gestreifte*. ("Striped.") In shape the fruit is much like that of Hubbard's Curled Leaf, but it is streaked and splashed with irregular lines of orange, or sometimes, even, the orange is predominant, the red assuming the position of stripes. Curious.—Prussia.

Group 3. The apple-shaped tomatoes. Fruit various in size or shape, but in normal forms more or less rounded on top, the monstrous or overgrown specimens developing a scar-like line or ring on the top and the ends of the fruit turning downwards. The Acme tomato and the Paragon may be taken as types of this division. Figure 8, illustrating a fruit of the Paragon, shows about the typical form of the fruit of this group.

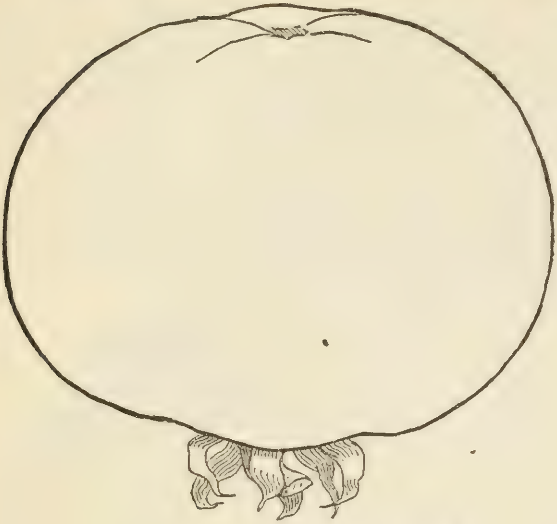

FIG. 8.

**Fruit yellow or yellowish-white.*

28. *Green Gage.* A small cherry-like sort, the fruits measuring about one and one-fourth or one and one-half inches in diameter, mostly spherical, sometimes slightly oblong.—College from Henderson.

This sort and the three next are valuable only for home use, especially in the making of pickles, etc. The foliage in this and some of its immediate allies tends to become "curled" as in most of the angular sorts.

29. *Large Yellow.* (*Jaune ronde grosse.*) Large and rounder than the last, two inches in diameter. Green Gage from Dickson, mostly, and from Neumann are the same as this.—College from Sibley, England, France, Prussia.

30. *Improved Large Yellow.* Darker in color than the last (orange), firmer, slightly angled. The fruits this year, raised from last year's fruits, were not so much angled as were those grown last year. Here, as in a few other cases, there appears to be some reversion towards the cherry type. Perhaps this should be closely associated with Orangefield, No. 11.—College from Thorburn.

31. *White Apple.* (*New White Apple. Nellis' Snowball. Ivory Ball. Apfel weisser.*) Fruit small and spherical, occasionally somewhat irregular, an inch or inch and a half in diameter, nearly white in color, soft, often two-celled. Valuable only as a curiosity.—College from Thorburn and Nellis, Landreth, Prussia.

32. *Golden Queen.* A short remove from the Large Yellow, flattish, reaching two and a half inches in diameter, and often becoming slightly angular, bright yellow. Smaller than last year.—College from Rawson.

33. *Yellow Jefferson.* (*Sunset.*) Rounder than the last, not inclining to become angular, strongly resembling a Paragon in size and shape, bright yellow, often with a red cheek. The most promising of the yellow tomatoes.—Leonard (Chicago) and Tillinghast.

34. *Golden Trophy.* (*Yellow Victor. Jaune grosse lisse.*) Strongly resembling Trophy in shape, but running a little smaller and often becoming somewhat angular; color, incostant, usually bright yellow, often shading into orange or red. Apt to become irregular.—College from Rawson and Gregory, France.

35. *Persian.* In shape and size very similar to the Conqueror; whitish-yellow. Evidently the White of Burr's Vegetables of America, 640.—College from Nellis.

***Fruit red or yellowish-red.*

36. *Little Gem.* Small (one and one-half to two inches in diameter), regular, spherical or slightly flattened. A short remove from the cherry tomatoes. It differs from Large Yellow apparently only in color. The Little Gem from Neumann was an angular sort, much like Hubbard's Curled Leaf.—Gregory.

37. *The Cook's Favorite.* Somewhat larger than the last (from one and one-half to two and one-half inches in diameter), firmer and better, somewhat angled. Apparently a step farther removed than the last from the cherry sorts.—College from Gregory, Prussia.

38. *Boston Market.* (*Fulton Market. Extra Early Red* of Ferry. *General Grant. Alpha.*) Fruit flattened, in average specimens about three inches broad the longest way by an inch and a half deep, somewhat cornered, bright clear red, firm. The fruit inclines to become double and distorted.

I can detect no constant or important distinctions between the several named varieties here combined with Boston Market. Fulton Market is perhaps inclined to be more regular, and to bear a well marked suture on one side. The General Grant, as figured and described at the time of its introduction (about 1870), was much more regular in shape than at present. These sorts possess little merit at the present day.—College from Rawson (Boston Market), College from Gregory, Prussia (Fulton Market), College from Henderson, Prussia, (General Grant), College from Thorburn (Alpha).

39. *Faultless.* (*Farguhar's Faultless*). Probably not distinct from the last, but appearing to run larger and more regular.—Gregory.

40. *New York Market.* Fruit mostly large and regular, about four inches across by two to two and one-half inches deep, bright light red; larger than Boston Market.—College from Nellis.

41. *Canada Victor.* Inconstant in size and shape, usually considerably flattened; about four inches broad by two deep, variously lobed; bright light red; solid. A popular variety formerly, but, as grown here this year and last, possessing no superior merits.—College from Henderson, Prussia.

42. *Trophy.* (*Nellis' Selected Trophy. Henderson's Extra Selected*

Trophy. Reed's Island Beauty. Island Beauty.) The typical Trophy is flattish, about four or five inches across by two and a half deep, regular, or very nearly so, often producing a small, regular ring on top, bright light red, with some shading of orange red, firm. In this form it is a good tomato. It is exceedingly liable to grow too large and irregular, however. The so-called selected stocks have shown no improvement over the ordinary stocks. The Trophy is evidently not so good as formerly. Our crop this year, from seeds of last year's crop, showed a much greater per cent of poor fruits than the crop of 1886. Introduced in 1870 by Col. Geo. E. Waring, Newport, R. I.—College from Henderson and Nellis, England, France, (Trophy); College from Henderson and Thorburn (Island Beauty).

Hackwood Park Prolific, from Dickson, *Santa Catharina* from Neumann, and *Blounts' Champion Cluster* from Alneer Bros., Rockford, Ill., were indistinguishable from Trophy.

43. *Bronze Foliage Trophy.* Stems, veins on the under side of the young leaves, and leaf-margins colored with indistinct, dark violet-purple, and the leaves darker dull green than in other plants; fruit similar to the last, later When the plants are young, the "bronze" was very marked, and throughout the season the darker color of the plants is noticeable at some distance.—College from Thorburn.

44. *Queen.* (*Cardinal. New Cardinal. Prize Belle. Livingston's Favorite. Market Champion. Champion. Mill's Belle.*) Fruit very uniform, seldom contorted, flattened, ordinary specimens three to four inches across, and two inches deep, slightly lobed, somewhat angled, glossy, yellowish red, firm and handsome. Valuable. This is an extreme development of the Angular tomatoes; one of the most attractive varieties. *Mamuth trauban* from Neumann appeared to be inseparable from Queen. —College from Nellis (Queen), College from Nellis and Henderson and Sibley, Thorburn, Root, Prussia, England (Cardinal), College from Buist, Tillinghast (Belle), College from Sibley and Henderson, England (Livingston's Favorite), College from Ford and Son (Market Champion), Prussia (Champion), Prussia (Mamuth Trauban), F. B. Mills, Thorn Hill, N. Y. (Mill's Belle.) *Glatte American*, from Neumann, also appears to be Queen.

45. *Red Valencia Cluster.* Fruit somewhat more angular than No. 44, more uniform in size and ripening. Probably not distinct from the last. A handsome sort.—College from Thorburn.

46. *Essex.* (*Essex Round Red Smooth.* Not "Essex Hybrid," for which see Acme.) Differs from the last, as it grew this year, in its smaller size. Perhaps not distinct.—College from Gregory.

47. *Hathaway.* (*Hathaway's Excelsior, New Red Apple.*) Ordinary fruit nearly spherical, one and a half to two and a half inches in diameter, perfectly regular, bright light red. A favorite sort. The New York Station regards Livingston's Favorite as the same as this. With us, however, the Favorite retains too much of the angled type to be associated with Hath-

away. The Hathaway appears to be a direct development of the cherry or plum tomato, while the other is evidently a development from the old Large Red. As compared with Essex, No. 46, Hathaway, is firmer, rounder, and has a greater tendency to crack about the stem.—College from Henderson, Root, England, France, Prussia (Hathaway), College from Gregory (New Red Apple).

48. *Tilden.* This variety, once so popular, appears to have run out. As grown this year the fruits were very small, irregular and worthless. Last year the fruits were somewhat larger, though smaller than Hathaway. When first introduced, now many years ago, it was a large tomato. In the tomato test at Chiswick, England, in 1867, Tilden was thought to be the same as such large sorts as Red Valencia Cluster, Lester's Perfected and New Giant Fiji Islands. Our stock may not be true.—College from Gregory, Landreth.

49. *Advance.* (*Extra Early Advance*). A small sort like the Hathaway, but earlier, the plant lower and smaller, and the fruit usually smaller (two inches or less in diamater). Hathaway from J. B. Root & Co. was evidently this variety, both in habit of plant and earliness. (For statement of earliness see synoptical Table).—College from Ford & Son, Burpee.

50. *Paragon.* Fruit constant in size and shape, three to four inches across and two inches deep, usually perfectly regular when ripe, bright light red, firm, and good. One of the best for main crop. Fig. 8.—College from Henderson, Prussia.

I cannot distinguish the following from Paragon: New Jersey (Landreth, Thorburn), Arlington (Gregory), Livingston's Perfection (College from Henderson, France), Emery (College from Rawson), Autocrat (College from Sibley), Mayflower (College from Henderson, Root, Prussia), Scoville (College from A. D. Perry & Co., Syracuse, N. Y., and from Perry again this year).

51. *Optimus.* A regular, meaty fruit, much like a good strain of Paragon; prolific.—D. M. Ferry & Co.

52. *Ignotum.* Fruit large to very large, regular, in shape like a large Paragon, exceedingly heavy and solid, keeping long. This variety appeared among plants which came from Prussian seeds bought for Eiformige Dauer. Other plants from the same lot of seeds produced small, angular fruits, and these plants I have taken to be the ones intended by the name Eiformige Dauer (see No. 12), and I have given, provisionally, the name Ignotum to this other and better sort. This is the best tomato which we grew this year. It may be an extra good strain of Paragon.

53. *Puritan.* Fruit large, solid, uniform, much like an extra fine Paragon, only that it tends to become slightly angled. Very fine.—Rawson.

54. *President Garfield.* Fruits very large, much doubled and contorted. Shapeless and worthless.—France.

*** *Fruits pink or pink purple.*

55. *Peach.* Plants producing many upright branches when allowed to fall upon the ground; foliage fine; fruit small and spherical

(one and one-half to two inches in diameter), very regular and uniform, indistinctly mottled with purple or red purple, the surface roughish, often two-celled, the juice very dark colored. A singular sort.—Landreth.

56. *Feejee.* (*Feejee Island. Lester's Perfected*). Fruit large and commonly irregular, often more or less contorted and bearing the brown elognated or circular scar on the apex, very firm, late. Not valuable. A notion was once current that this tomato was introduced from the Feejee Islands. It is said by White to have been brought into the vicinity of Athens, Georgia, from Naples, Italy, as long ago as 1848. Probably the first of the pink tomatoes.—College from Henderson, Prussia.

57. *Acme.* (*Rochester. Rochester Favorite. Livingston's Beauty. Climax. Hovey. Essex Hybrid*). Variable in size, but ordinarily running about like the Paragon and differing from it chiefly in color. Acme was introduced in 1877. One of the best varieties in cultivation.—College from Henderson and Gregory, England, France, Prussia (Acme), College from Gregory and Sibley (Favorite), College from Rawson, Livingston (Livingston's Beauty), College from Rawson (Climax),

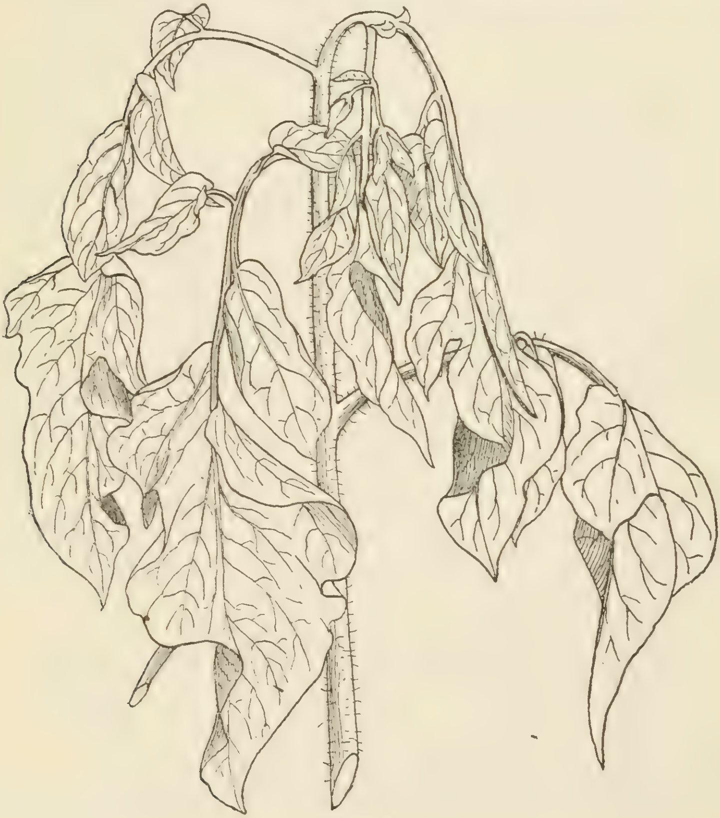

FIG. 9.

College from Thorburn and again from Thorburn this year (Hovey), College from Henderson (Essex Hybrid).

D. GRANDIFOLIUM.—Large-leaf tomatoes. Habit and fruit as in section C; leaves very large; leaflets fewer than common (about two pairs), large (the blade thre to four inches long and an inch and a half wide), entire, the lower side strongly decurrent. Leaves of the young plants entire! The terminal leaflet is often six inches long and four or more inches broad. This peculiar foliage occurs in Nisbit's Victoria also. Fruit pink. Fig. 9 shows the peculiar foliage of this section, and Fig. 10, much reduced, shows a single leaf.

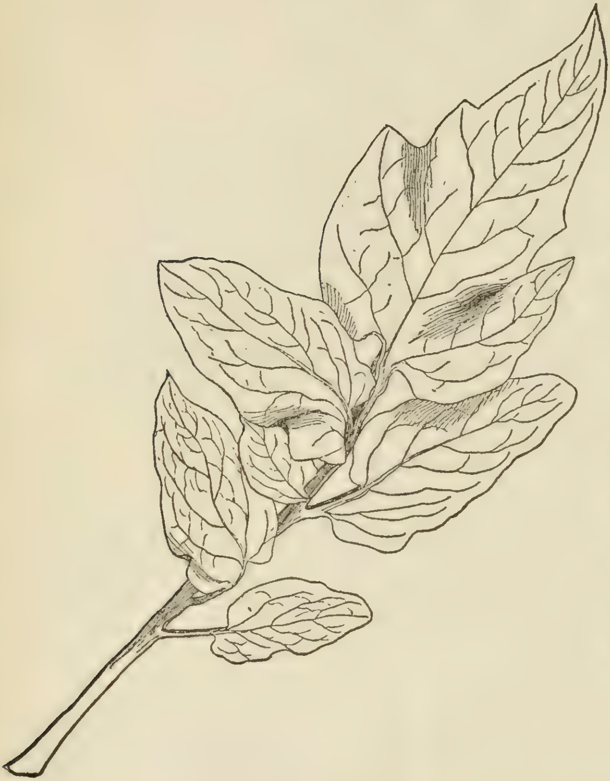

FIG. 10.

58. *Potato Leaf.* Fruit very regular and uniform, very much like Acme. Evidently a very fine sort, more uniform in size and shape of fruit than the next.—Livingston.

59. *Mikado.* (*Turner Hybrid*). Fruit very large, usually irregular, much resembling Trophy, only that the color is pinkish-purple. Too irregular to be recommended. Figs. 9 and 10.—College from Henderson, England (Mikado), College from Burpee and again from Burpee this year (Turner Hybrid) Maule (Maule's $1600 strain).

E. VALIDUM.—Upright tomato. Stem very thick and stout, the plants nearly sustaining themselves, two to two and a half feet high; leaves very dark green, short and dense, the leaflets wrinkled and more or less recurved. An odd plant with much the aspect of a potato plant. Fig. 11.

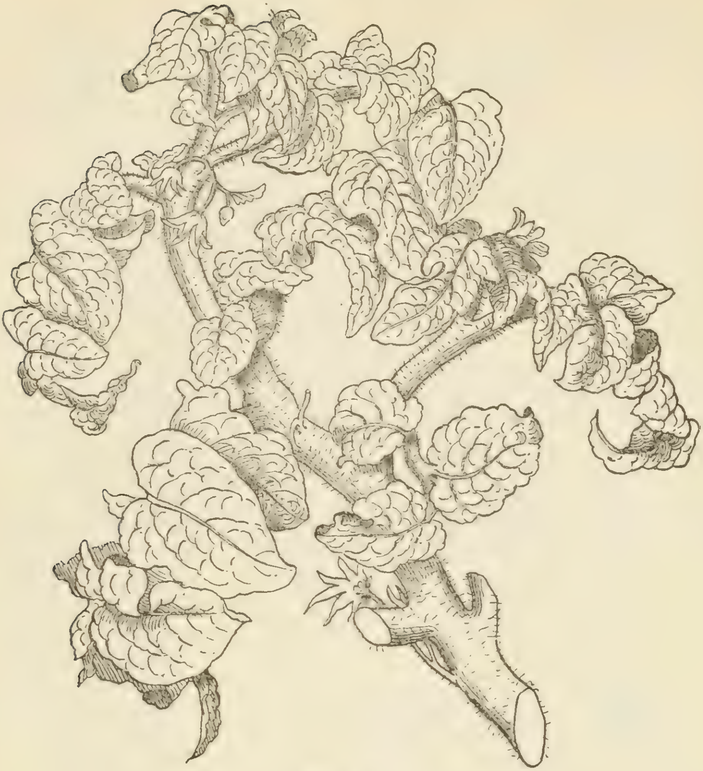

FIG. 11.

60. *French Upright or Tomate de Laye* (*Tree Tomato. Tomate à Tige Roide*). Fruit very irregular on the sides and base, more or less cornered, nearly as large as Trophy, flattened, bright yellowish-red, very solid and very late. Used for pot culture in France. A chance seedling in the garden of M. de Fleurieux, raised by Grenier, his gardener, some thirty years ago, at Chateau de Laye, near Villefranche, France. Fig. 11.—College from Thorburn, France, Prussia.
61. *Station.* Plant indistinguishable from the last; fruit much smaller (one and one-half to two and one-half inches in diameter), uniform in size, nearly regular. A cross between the French Upright and Alpha, reared at the N. Y. Experiment Station. The Alpha was the male parent. Figured and described in American Garden, December, 1886, 364.—N. Y. Experiment Station.

II. NOTES ON PEPPERS.—Thirty-five named sorts of peppers were grown this year. The varieties made an attractive collection, especially as they presented many various forms and colors of fruit and varied habits of growth. In fact, the fruit of the pepper varies into almost every shape. From the

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NOTE.—*Cincinnati Purple* from D. M. Ferry & Co., was evidently untrue, as none of the plants produced pink or purple fruits.

SYNOPTICAL TABLE.

The dashes indicate that the plant was examined upon that day, but that no ripe fruits were observed. Whenever the column is marked only with dots it is an indication that no notes were taken that day upon the plant in question.

Varieties.—(Concluded on next page.)	Aug. 15.		Aug. 18.		Aug. 19.		Aug. 20.		Aug. 26.		Aug. 29.		Aug. 30.		Aug. 31.		Sept. 2.		Sept. 3.		Sept. 7.		Sept. 13.		Sept. 15.		Sept. 16.	
	o. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight. oz	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.
1. Currant	—	—	150	5	....	....	—	—	....	....	180	5½	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Same, from Prussia	—	—	85	3	....	....	30	1	....	....	....	....	....	....	120	4	....	....	....	....	....	....	....	....	....	....	....	....
2. Red Cherry	13	2	30	5½	....	....	12	2	....	....	42	7½	....	....	....	....	....	....	42	7	....	....	....	....	....	....	....	....
Same, from Prussia	12	2½	20	6	....	....	3	1	....	....	50	12	....	....	....	....	....	....	80	18	....	....	....	....	....	....	....	....
Same, from France	19	11	14	9	....	....	8	7	....	....	....	....	....	....	28	20	....	....	....	....	....	....	....	....	....	....	....	....
3. Yellow Cherry	31	3½	12	2	....	....	4	1	....	....	....	....	45	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Same, from Prussia	19	4	7	2½	....	....	13	4	....	....	....	....	35	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....
4. Pear—France	3	1	10	4	....	....	—	—	....	....	18	5½	....	....	....	....	....	....	41	12	....	....	....	....	....	....	....	....
Queen of Tomatoes	—	—	7	3	....	....	3	½	....	....	....	....	....	....	20	8	....	....	....	....	....	....	....	....	....	....	....	....
5. Nisbit's Victoria	2	1	6	3½	....	....	—	—	....	....	....	....	....	....	23	11	....	....	....	....	....	....	....	....	....	....	....	....
Same, from England	9	5	2	2	....	....	—	—	....	....	....	....	....	....	....	....	14	7½	....	....	....	....	....	....	....	....	....	....
6. Fig—Wonder of Italy	—	—	5	5	....	....	2	2	....	....	....	....	20	19½	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Rothe Birne	—	—	4	5½	....	....	3	2½	....	....	7	4½	....	....	....	....	....	....	9	5	....	....	....	....	....	....	....	....
7. Red Plum—Pear of Henderson	—	—	10	6½	....	....	—	—	....	....	1	½	....	....	....	....	....	....	9	5	....	....	....	....	....	....	....	....
8. Yellow Plum	8	4½	....	....	7	4	4	2	....	....	....	....	....	....	....	....	12	8	....	....	....	....	....	....	....	....	....	....
9. King Humbert	—	—	—	—	....	....	—	—	....	....	....	....	....	....	6	16	....	....	....	....	....	....	....	....	....	....	....	....
Same, from France	1	1	....	....	2	2	3	3½	....	....	....	....	....	....	....	....	23	37½	....	....	....	....	....	....	....	....	....	....
Same, from England	—	—	3	1½	....	....	—	—	....	....	....	....	....	....	....	....	18	31	....	....	....	....	....	....	15	32	....	....
10. Criterion	—	—	—	—	....	....	—	—	....	....	5	10½	....	....	....	....	....	....	4	7½	....	....	....	....	....	....	....	....
Same, from England	—	—	5	7	....	....	—	—	....	....	....	....	11	26½	....	....	....	....	....	....	6	5½	....	....	....	....	....	....
11. Orangefield	2	3	—	—	....	....	2	2	....	....	....	....	16	17	....	....	....	....	....	....	10	8	....	....	....	....	....	....
13. Hundred Days	4	6	2	3	....	....	2	4	....	....	6	20	....	....	12	20	....	....	....	....	....	....	8	12	....	....	....	....
Same, from Prussia	3	6½	....	....	2	5½	—	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8	18½	....	....
14. Cedar Hill	—	—	1	3	....	....	—	—	....	....	....	....	....	....	11	24½	....	....	....	....	....	....	14	28	....	....	....	....
15. Conqueror	7	15½	....	....	2	4	4	11	....	....	....	....	....	....	....	....	5	14	....	....	....	....	....	....	....	....	21	71
Same, from England	2	6	6	18	....	....	3	7	16	43½	....	....	....	....	....	....	....	....	10	32	....	....	....	....	....	....	....	....
Same, from Prussia	3	11	....	....	5	8	—	—	....	....	....	....	....	....	....	....	9	18½	....	....	....	....	....	....	....	....	....	....
16. Large Red	3	8½	1	2	....	....	—	—	10	31½	....	....	....	....	....	....	....	....	23	54	....	....	....	....	....	....	....	....
Rouge grosse	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	10	52	....	....	....	....	....	....	....	....	....	....
Franz gross rothe	—	—	4	11	1	5½	—	—	2	6½	....	....	....	....	....	....	....	....	4	15½	....	....	....	....	....	....	....	....
17. Early Richmond	9	26	3	7½	....	....	—	—	....	....	19	44	....	....	....	....	....	....	....	....	2	7½	....	....	....	....	....	....
18. Bermuda	—	—	—	—	....	....	—	—	....	....	....	....	2	10½	2	4	....	....	....	....	7	28½	....	....	....	....	....	....
19. Precursor	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	....	....	....	....	7	19½	....	....	....	....	....	....
20. Cluster	6	9½	5	14	....	....	2	5	....	....	....	....	13	32	....	....	....	....	....	....	8	16	....	....	....	....	....	....

SYNOPTICAL TABLE.—CONTINUED.

Varieties.- (Concluded from last page.)	Sept. 17.		Sept. 19.		Sept. 20.		Sept. 21.		Sept. 22.		Sept. 23.		Sept. 24.		Total No. of fruits for the season.	Total weight of fruits for the season, oz.	Weight of plant,—oz.	Average weight of a fruit, oz.	Ratio of weight of fruit to weight of plant.	No. of days in germinating.	Per cent. of germination.
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. green and ripe.	Weight, oz.							
1. Currant							300	7	350	8			4,400	69	5,380	94½	69	1-100	1 3-10	17	100.
Same, from Prussia							250	6			180	5	2,600	56	3,265	75	56	2-100	1 3-10	14	70.
2. Red Cherry									207	35			1,144	152	1,490	211	126	1-10	1 3-5	15	84.4
Same, from Prussia									165	36			433	132	763	207	89½	1-5	2 3-10	14	66.
Same, from France					140	75					32	8½	431	192	672	322½	57½	2-5	5 3-5	15	68.
3. Yellow Cherry											280	35	1,328	88	1,600	135½	81	2-25	1 3-5	17	100.0
Same, from Prussia											200	56	765	2-8	1,039	364½	56½	3-10	6 2 5	17	60 0
4. Pear—France									71	16			532	112	675	143	85	1-5	1 3-5	13	80.0
Queen of Tomatoes							134	61			15	80	465	136	644	288½	49	2-5	5 4-5	17	30.0
5. Nisbit's Victoria							135	50			25	9½	543	204	634	270	90	2-5	3	14	100.0
Same, from England					57	27							807	352	889	393	101½	11 25	19-50	11	80.0
6. Fig—Wonder of Italy							59	33					253	168	339	227½	75	3-5	3 3 100	14	84.0
Rothe Birne									66	36			256	136	345	189½	142	27-50	1 3-10	14	76.0
7. Red Plum—Pear of Henderson									7	26			200	104	237	143	84	3 5	1 7 10	14	100.
8. Yellow Plum					100	56							708	216	839	290½	104½	17 50	2 7-10	13	81.2
9. King Humbert					17	48					27	72	295	384	345	524	77	1 1-2	6 4-5	12	82.
Same, from France	73	75											443	314	545	463	92½	13-20	5	12	92.
Same, from England													271	288	307	355½	57½	1 3-20	6 1-10	13	92.
10. Criterion											22	34	126	144	157	196	60½	1 1 5	3 1-5	9	78.
Same, from England											22	44	175	224	219	307	97	1 2-5	3 1-10	11	84.
11. Orangefield											51	46	312	152	393	228	113½	29-50	2	21	48.6
13. Hundred Days											16	30	50	41½	100	139½	20½	1 39-100	6 4-5	19	88.
Same, from Prussia											7	17	21	21½	41	72	24	1 7-10	3	19	30
14. Cedar Hill											29	61	107	160	152	253	83½	1 3-5	3 3-100	14	34.
15. Conqueror											14	40	46	59	99	214	41	2 4-25	5 2-10	13	91.6
Same, from England									3	13			85	114	125	233½	84	1 43-50	2 7-10	13	76.
Same, from Prussia			16	2							9	16	54	66½	97	112	32	1 3-20	3 1-2	13	66.
16. Large Red									10	24			148	272	195	392	133	2 1-100	2 47-50	13	64.
Rouge grosse			20	68½							19	61½	163	384	212	566	92	2 33-50	6 3 20	12	78.
Franz gross rothe									15	36			107	176	1.3	248½	63	2 1-50	3 47-50	14	66.
17. Early Richmond											30	44	70	114	133	343	72	2 57-100	4 19-25	13	74.
18. Bermuda											25	103	101	260	137	306	128	2 23-100	2 39-100	12	60.
19. Precursor											28	79	45	56	80	154½	58½	1 93-100	2 16-25	16	88.8
20. Cluster											12	21	49	48	95	145½	34½	1 53-100	4 1-5	13	28.

SYNOPTICAL TABLE.—CONTINUED.

Varieties.—(Concluded on next page.)	Aug. 15.		Aug. 18.		Aug. 19.		Aug. 20.		Aug. 26.		Aug. 29.		Aug. 30.		Aug. 31.		Sept. 2.		Sept. 3.		Sept. 7.		Sept. 13.		Sept. 15.		Sept. 16.	
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.
21. Jackson	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	6	32½	....	....	....	....	....	....	....	....	....	....
22. Turk's Cap	1	2	....	....	—	—	3	4	....	....	....	....	....	....	....	....	1	2	....	....	....	....	....	....	....	....	....	....
23. Early Dwarf Red	—	—	1	2½	....	....	—	—	....	....	11	35	....	....	....	....	....	....	15	48	....	....	....	....	....	....	....	....
Rouge naine hative	—	—	1	2	....	....	—	—	....	....	4	8½	....	....	....	....	....	....	1	3	....	....	....	....	....	....	....	....
Frühe rothe zwerg	3	7	3	6	....	....	1	2½	....	....	....	....	13	20½	....	....	....	....	....	....	8	9½	....	....	....	....	....	....
24. Hubbard's Curled Leaf	3	13	4	9½	....	....	—	—	18	44	....	....	....	....	....	....	....	....	14	32	....	....	....	....	....	....	....	....
Krausblätter	3	5	2	6	....	....	—	—	....	....	13	35	....	....	....	....	....	....	17	50½	....	....	....	....	....	....	....	....
Rouge grosse hative	7	19	2	4	....	....	—	—	7	14½	....	....	....	....	....	....	14	30½	....	....	....	....	....	....	....	....	....	....
25. Keyes	—	—	....	....	—	—	2	7½	....	....	....	....	....	....	....	....	16	37	....	....	....	....	....	....	....	....	9	17½
26. Tom Thumb	2	2½	2	6½	....	....	—	—	5	12	....	....	....	....	....	....	....	....	7	16½	....	....	....	....	....	....	....	....
27. Gestreifte	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	2	4	....	....	....	....	....	....	6	11½	....	....
28. Green Gage	24	13½	24	11½	....	....	20	10	....	....	....	....	31	14	....	....	....	....	....	....	....	....	....	....	....	....	....	....
29. Large Yellow	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	2	1½	....	....	....	....	....	....	....	....	....	....
30. Improved Large Yellow	—	—	....	....	—	—	—	—	....	....	—	—	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....
31. White Apple	—	—	3	3½	....	....	—	—	....	....	—	—	....	....	....	....	....	....	2	3	....	....	....	....	....	....	....	....
Snowball	—	—	3	3½	....	....	—	—	....	....	—	—	....	....	....	....	....	....	23	28½	....	....	....	....	....	....	....	....
Ivory Ball	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....	....	....
Same, from Prussia	—	—	—	—	....	....	—	—	....	....	....	....	6	6½	....	....	....	....	....	....	....	....	....	....	....	....	....	....
32. Golden Queen	—	—	—	—	....	....	—	—	....	....	2	6	....	....	....	....	....	....	2	5½	....	....	....	....	....	....	....	....
34. Golden Trophy	—	—	—	—	....	....	—	—	....	....	....	....	—	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yellow Victor	—	—	1	3½	....	....	1	2	....	....	....	....	5	7	....	....	....	....	....	....	7	14½	....	....	....	....	....	....
Jaune grosse lisse	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	2	6	....	....	....	....	....	....	....	....	....	....
35. Persian	—	—	—	—	....	....	—	—	....	....	—	—	....	....	....	....	....	....	2	5½	....	....	....	....	....	....	....	....
36. Little Gem	2	1½	....	....	6	7	3	3½	....	....	....	....	....	....	....	....	6	6½	....	....	....	....	....	....	....	....	....	....
37. The Cook's Favorite	—	—	....	....	3	5	—	—	....	....	....	....	....	....	....	....	9	14	....	....	....	....	....	....	....	....	....	....
Same, from Prussia	—	—	3	5	....	....	—	—	7	12	....	....	....	....	....	....	12	27½	....	....	....	....	....	....	....	....	....	....
38. Boston Market	3	7	3	9½	....	....	2	4	5	12½	....	....	....	....	....	....	....	....	5	17	....	....	....	....	....	....	....	....
Fulton Market	2	5	—	—	....	....	—	—	7	19½	....	....	....	....	....	....	....	....	15	40	....	....	....	....	....	....	....	....
Fulton Market, Prussia	3	5½	1	3½	....	....	—	—	....	....	12	37½	....	....	....	....	....	....	1	4	....	....	....	....	....	....	....	....
General Grant	9	14	8	15½	....	....	1	3½	....	....	12	22½	....	....	....	....	....	....	....	....	14	18	....	....	....	....	....	....
Alpha	1	4	—	—	....	....	1	2	....	....	....	....	....	....	14	38½	....	....	....	....	....	....	10	17	....	....	....	....
39. Faultless	1	3½	....	....	2	5	—	—	....	....	....	....	....	....	12	33	....	....	....	....	....	....	....	....	12	38	....	....
40. New York Market	2	3½	1	3	....	....	1	3½	10	28½	....	....	....	....	....	....	....	....	3	7½	....	....	....	....	....	....	....	....
41. Canada Victor	—	—	—	—	....	....	1	2½	....	....	....	....	7	21½	....	....	....	....	....	....	4	11½	....	....	....	....	....	....
Same, from Prussia	6	16	5	11½	....	....	—	—	....	....	....	....	7	19	....	....	....	....	....	....	4	7½	....	....	....	....	....	....

SYNOPTICAL TABLE.—CONTINUED.

Varieties.—(Concluded from last page.)	Sept. 17.		Sept. 19.		Sept. 20.		Sept. 21.		Sept. 22.		Sept. 23.		Sept. 24.		Total of fruits for the season.	Total weight of fruits for the season.—oz.	Weight of plant,—oz.	Average weight of a fruit.—oz.	Ratio of weight of fruit to weight of plant.	No. of days in germinating.	Per cent of germination.
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. green and ripe.	Weight, oz.							
21. Jackson	5	20									12	46	64	128	87	226½	37	2.6	6 1-10	17	72
22. Turk's Cap											15	15	184	200	204	223	76	1 1-10	3	16	68
23. Early Dwarf Red											18	48	134	140	169	273	54	1 3-5	5	13	84
Rouge naine hative											33	59	151	120	190	192½	40½	1	4 7-10	13	90
Frühe rothe zwerg											39	58	161	180	228	283½	98½	1 1-4	2 9-10	11	78
24. Hubbard's Curled Leaf									17	48			95	99	151	245½	57½	1 3-5	4 3-4	15	62.5
Krausblätter											55	162	160	109½	250	363	74½	1 2-5	4 9-10	16	58
Rouge grosse hative									50	101			60	120	140	289	79	2	3 3-5	11	92
25. Keyes											19	46	46	53½	92	161½	33	1 3-4	4 9-10	16	64
26. Tom Thumb									10	24			86	116	112	177½	50½	1 3-5	3 1-2	13	96
27. Gestreifte											19	45½	67	128	91	188½	38	2	4 9-10	19	68
28. Green Gage							113	40			5	40	247	88	464	227	45½	1-2	5	13	100
29. Large Yellow					33	30							192	188	272	219	75	3-4	2 9-10	13	75
30. Improved Large Yellow									6	16			121	88	127	104	59½	4-5	1 3-4	13	40
31. White Apple									37	39			391	224	433	269½	134	3-5	2	12	100
Snowball									31	30			166	88	223	150	71	2-3	2 1-10	13	78
Ivory Ball					26	34							315	176	341	210	65½	3-5	3 1-5	13	90
Same, from Prussia							60	42			—	—	204	104	270	152½	75½	3-5	2	14	48
32. Golden Queen											23	42	57	112	84	165½	65	2	2 1-2	13	82
34. Golden Trophy					20	67½					3	12½	61	160	84	240	83	2 9-10	2 9-10	12	87.8
Yellow Victor											4	76	90	104	108	207	48	1 9-10	4 3-10	13	91.6
Jaune grosse lisse													75	320	77	326	77½	4 1-4	4 1-4	13	92
35. Persian									3	9			66	128	71	142	40	2	3 1-2	17	24
36. Little Gem	28	26											415	312	460	356½	68	3-4	5 1-4	13	48
37. The Cook's Favorite			37	60½							8	14½	121	144	178	238	52	1 1-3	4 3-5	13	96
Same, from Prussia									20	50			114	215	159	109	52	2-3	2 1-10	11	54
38. Boston Market			28	33					29	72			83	136	158	291	68	1 4-5	4 3-10	18	79
Fulton Market									26	84			51	128	95	276½	76	2 9-10	3 2-3	14	92.3
Fulton Market, Prussia											47	136	96	200	160	285	80	1 7-10	3 1-2	11	56
General Grant											34	64	87	72½	165	209½	63	1 1-5	3 1-3	13	95.8
Alpha											25	66	73	88	124	215	62	1 3-4	2 1-2	12	63.1
39. Faultless											15	34	72	56	114	169	38	1 1-2	4 4-10	12	42
40. New York Market									30	80			89	196	136	392	128	2 9-10	3 1-5	17	84.6
41. Canada Victor											32	60	62	68	106	163½	40	1 1-2	4 1-10	16	93.4
Same, from Prussia											26	58	93	176	141	288	85½	2	3 2-5	14	26

SYNOPTICAL TABLE.—CONTINUED.

Varieties.—(Concluded on next page.)	Aug. 15.		Aug. 18.		Aug. 19.		Aug. 20.		Aug. 26.		Aug. 29.		Aug. 30.		Aug. 31.		Sept. 2.		Sept. 3.		Sept. 7.		Sept. 13.		Sept. 15.		Sept. 16.	
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight. oz.
42. Trophy—Henderson	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....	4	19
Same, Nellis	—	—	....	....	—	—	—	—	....	....	....	....	....	....	4	16	....	....	....	....	....	....	....	....	4	16	....	....
Same, from England	—	—	—	—	....	....	—	—	1	2½	....	....	....	....	....	....	....	....	2	7	....	....	....	....	....	....	....	....
Island Beauty—Henderson	—	—	—	—	....	....	—	—	....	....	2	3	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....
43. Bronze Foliage Trophy	—	—	—	—	....	....	—	—	....	....	....	....	—	—	....	....	....	....	....	....	1	2	....	....	....	....	....	....
44. Queen	1	3	—	—	....	....	—	—	....	....	....	....	....	....	3	17	....	....	....	....	....	....	8	26½	....	....	....	....
Cardinal—Henderson	4	8½	7	22½	....	....	2	4½	....	....	....	....	....	....	13	38½	....	....	....	....	....	....	....	....	25	73½	....	....
Cardinal—Sibley	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....	19	132
Cardinal—Thorburn	—	—	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....
Cardinal—Prussia	2	5	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	3	9	....	....	....	....	....	....	....	....
Cardinal—England	—	—	—	—	....	....	—	—	....	....	4	8½	....	....	....	....	....	....	7	17	....	....	....	....	....	....	....	....
Prize Belle—Buist	—	—	1	3½	....	....	—	—	....	....	....	....	3	7	....	....	....	....	....	....	11	40	....	....	....	....	....	....
Belle—Tillinghast	—	—	—	—	....	....	—	—	....	....	....	....	....	....	3	7½	....	....	....	....	....	....	6	17	....	....	....	....
Livingston's Favorite—Henderson	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	6	26	....	....	....	....	....	....	....	....	....	....
Livingston's Favorite—Sibley	1	3	....	....	2	7½	—	—	....	....	....	....	....	....	....	....	1	3½	....	....	....	....	....	....	....	....	17	87
Livingston's Favorite—England	—	—	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	2	½	....	....	....	....	....	....	....	....
Market Champion	2	5	—	—	....	....	—	—	6	11½	....	....	....	....	....	....	....	....	7	14	....	....	....	....	....	....	....	....
Champion—Prussia	—	—	—	—	....	....	—	—	....	....	3	14	....	....	....	....	....	....	3	14½	....	....	....	....	....	....	....	....
Mill's Belle	3	8½	5	15½	....	....	—	—	....	....	5	11	....	....	....	....	....	....	9	12	....	....	....	....	....	....	....	....
Mamuth Trauban	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	2	8	....	....	....	....	....	....	....	....	....	....
45. Red Valencia Cluster	1	1	—	—	....	....	—	—	....	....	....	....	....	....	....	....	5	24	....	....	....	....	....	....	8	30½	....	....
46. Essex	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	....	....	....	....	9	19	....	....	....	....	....	....
47. Hathaway—Henderson	—	—	2	5	....	....	—	—	....	....	....	....	4	6½	....	....	....	....	....	....	7	10½	....	....	....	....	....	....
Same, from Root	4	7½	—	—	....	....	—	—	....	....	....	....	9	17	6	12½	....	....	....	....	....	....	23	48	....	....	....	....
Same, from England	—	—	1	3	....	....	—	—	....	....	....	....	....	....	....	....	6	10	....	....	....	....	....	....	....	....	19	29
Same, from France	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	1	1½	....	....	....	....	....	....	24	58	....	....
Same, from Prussia	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	3	8	....	....	....	....	....	....	....	....	....	....
New Red Apple	1	3½	1	3	....	....	1	2	4	9	....	....	....	....	....	....	....	....	8	17½	....	....	....	....	....	....	....	....
48. Tilden—Gregory	7	11½	6	10	....	....	—	—	12	16½	....	....	....	....	....	....	....	....	6	8	....	....	....	....	....	....	....	....
Same, from Landreth	—	—	2	7	....	....	—	—	....	....	2	9½	....	....	....	....	....	....	8	20	....	....	....	....	....	....	....	....
49. Advance—Ford	7	15	11	14	....	....	—	—	....	....	....	....	14	18½	....	....	....	....	....	....	9	9½	....	....	....	....	....	....
Same, from Burpee	8	12½	6	9½	....	....	—	—	....	....	....	....	23	33	....	....	....	....	....	....	7	14	....	....	....	....	....	....
50. Paragon	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	3	9	....	....	....	....	....	....	....	....	....	....
Same from Prussia	—	—	—	—	....	....	—	—	3	6½	....	....	....	....	....	....	5	13	....	....	....	....	....	....	....	....	....	....
Emery	—	—	1	3	....	....	—	—	5	16	....	....	....	....	....	....	10	24	....	....	....	....	....	....	....	....	....	....

SYNOPTICAL TABLE.—CONTINUED.

Varieties.—(Concluded from last page.)	Sept. 17.		Sept. 19.		Sept. 20.		Sept. 21.		Sept. 22.		Sept. 23.		Sept. 24.		Total No. of fruits for the season.	Total weight of fruits for the season.—oz.	Weight of plant—oz.	Average weight of a fruit.—oz.	Ratio of weight of fruit to weight of plant.	No. of days in germinating.	Per cent. of germination.
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. green and ripe.	Weight, oz.							
42. Trophy—Henderson											5	29½	37	168	46	216½	41	4 7-10	5 3-10	12	83.3
Same, Nellis											24	95	65	136	97	263	56½	2 7-10	4 6-10	13	100
Same, from England									16	2	87	204			106	215½	122	2	1 3-4	10	84
Island Beauty—Henderson											2	6	90	344	94	353	36	3 3-4	9 4-5	13	93.3
43. Bronze Foliage Trophy											3	12	94	280	98	294	104	3	2 4-5	13	69.2
44. Queen											29	92	81	212	122	350½	146	2 4-5	2 2-5	17	71.4
Cardinal—Henderson											27	81	114	200	192	428½	83½	2 1-4	5 1-10	16	90
Cardinal—Sibley													68	184	87	316	96	3 3-5	3 3-10	14	82.5
Cardinal—Thorburn									11	32			134	292	145	324	239	2 1-4	1 3-10	12	84
Cardinal—Prussia									25	63	27	187	166	416	223	680	179½	3	3 4-5	12	68
Cardinal—England											21	50	110	212	142	287½	91½	2	3 1-10	12	48
Prize Belle—Buist											31	124	75	208	125	382½	83	3	4 3-5	17	75
Belle—Tillinghast											9	28	77	160	95	212½	85	2 1-4	2 1-2	10	68
Livingston's Favorite—Henderson			15	74½									50	144	71	244½	75½	3 2-5	3 2-10	—	—
Livingston's Favorite—Sibley			14	68½							3	11	87	248	125	428½	124	3 2-5	3 1-2	17	90
Livingston's Favorite—England									4	16			61	168	67	189½	58½	2 4-5	3 1-4	13	68
Market Champion									46	94			212	288	273	412½	138½	1 1-2	3	13	100
Champion—Prussia											5	10	93	288	114	326½	96	2 9-10	3 2-5	13	38
Mill's Belle											25	53	69	164	116	264	78	2 1-4	3 2-5	12	66
Mamuth Trauban	4	19											67	256	73	283	58½	3 9-10	4 4-5	13	46
45. Red Valencia Cluster											17	59	106	156	127	270½	96	2 2-10	2 4-5	17	90
46. Essex											54	95½	120	128	183	242½	84½	1 3-10	2 9-10	13	100
47. Hathaway—Henderson											46	80	106	144	165	246	96	1 1-2	2 3-5	13	100
Same, from Root											18	36	71	132	131	253	73	1 9-10	3 1-2	12	90
Same, from England			8	16									145	224	179	282	105	1 3-5	2 2-3	9	62
Same, from France											34	5½	154	336	213	401	142	1 9-10	2 4-5	12	80
Same, from Prussia			27	72							14	44½	113	280	157	402½	104½	2 3-5	3 9-10	13	90
New Red Apple									46	100			108	278	169	402½	116	2 19-50	3 2-5	15	34
48. Tilden—Gregory									31	52			198	252	260	350	136	1 3-10	2 1-2	16	92.8
Same, from Landreth											15	50	132	130	159	216½	111½	1 3-10	1 9-10	14	20
49. Advance—Ford											67	84	91	68	199	209	84½	1 1-20	2 2-5	17	86.6
Same, from Burpee											35	58	89	92	168	219	60½	1 3-10	3 3-5	13	9.4
50. Paragon			32	144							2	13	67	184	104	350	92½	3 3-10	3 39-50	13	76.9
Same, from Prussia									20	63			111	156	139	238½	126	1 7-10	1 9-10	11	86
Emery									17	45			125	344	158	432	133	2 7-10	3 17-100	9	66

SYNOPTICAL TABLE.—CONTINUED.

Varieties.—(Concluded on next page.)	Aug. 15.		Aug. 18.		Aug. 19.		Aug. 20.		Aug. 26.		Aug. 29.		Aug. 30.		Aug. 31.		Sept. 2.		Sept. 3.		Sept. 7.		Sept. 13.		Sept. 15.		Sept. 16.	
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.
50. Paragon—*Continued:*																												
Livingston's Perfection	—	—	—	—	....	....	—	—	....	....	....	....	....	....	10	23	....	....	....	....	....	....	7	17	....	....	....	....
Livingston's Perfection—France	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	5	10½	....	....	....	....	....	....	9	26½	....	....
Autocrat	2	4	2	6	....	....	2	5½	15	30	....	....	....	....	....	....	....	....	7	15	....	....	....	....	....	....	....	....
Mayflower—Henderson	—	—	—	—	....	....	—	—	....	....	....	....	3	9	....	....	....	....	....	....	10	16	....	....	....	....	....	....
Mayflower—Root	—	—	—	—	....	....	—	—	....	....	....	....	1	7½	....	....	....	....	....	....	6	18	....	....	....	....	....	....
Mayflower—Prussia	8	11	15	22½	....	....	9	11	....	....	....	....	....	....	18	25	....	....	....	....	....	....	48	56	....	....	....	....
Scoville—Perry, 1886	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	8	17½	....	....	....	....	....	....	14	28	....	....
Scoville—Perry, 1887	1	5½	....	....	—	—	—	—	....	....	....	....	....	....	....	....	2	7	....	....	....	....	....	....	....	....	16	55
51. Optimus	—	—	—	—	....	....	—	—	....	....	3	10	....	....	....	....	....	....	5	14½	....	....	....	....	....	....	....	....
53. Puritan	—	—	—	—	....	....	—	—	....	....	....	....	....	....	3	15½	....	....	....	....	....	....	....	....	....	....	....	....
54. President Garfield	—	—	—	—	....	....	—	—	....	....	....	....	—	—	....	....	....	....	....	....	3	22	....	....	....	....	....	....
55. Peach	—	—	3	5½	....	....	—	—	....	....	....	....	17	22	....	....	....	....	....	....	6	8	....	....	....	....	....	....
56. Feejee	—	—	—	—	....	....	—	—	2	8½	....	....	....	....	....	....	....	....	3	8½	....	....	....	....	....	....	....	....
Same, from Prussia	—	—	1	8	....	....	—	....	....	....	6	12½	....	....	....	....	....	....	....	....	19	26	....	....	....	....	....	....
57. Acme—Henderson	—	—	1	4	....	....	2	7½	....	....	....	....	....	....	21	57	....	....	....	....	....	....	19	43	....	....	....	....
Same, from Gregory	—	—	4	13½	....	....	—	—	....	....	....	....	....	....	....	....	7	22	....	....	....	....	....	....	22	91	....	....
Same, from England	1	4½	....	....	1	5	—	—	....	....	....	....	....	....	....	....	1	4½	....	....	....	....	....	....	....	....	....	....
Same, from France	—	—	....	....	2	11	—	—	....	....	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....	....	....
Same, from Prussia	—	—	1	4	....	....	—	—	—	—	....	....	....	....	....	....	....	....	3	11	....	....	....	....	....	....	....	....
Rochester Favorite	—	—	—	—	....	....	1	4	....	....	....	....	2	8	....	....	....	....	....	....	3	11	....	....	....	....	....	....
Rochester Favorite—Gregory	—	—	—	—	....	....	—	—	....	....	....	....	4	15	....	....	....	....	....	....	2	8	....	....	....	....	....	....
Livingston's Beauty—Sibley	—	—	2	4	....	....	—	—	3	9	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....
Livingston's Beauty—Rawson	—	—	—	—	....	....	—	—	....	....	3	7½	....	....	....	....	....	....	3	3	....	....	....	....	....	....	....	....
Climax—Livingston	—	—	—	—	....	....	1	2	....	....	....	....	5	15	....	....	....	....	....	....	2	5	....	....	....	....	....	....
Hovey—Thorburn, 1886	1	2	—	—	....	....	—	—	....	....	....	....	4	8	....	....	....	....	....	....	7	14	....	....	....	....	....	....
Hovey—Thorburn, 1887	—	—	—	—	....	....	—	—	....	....	....	....	....	....	1	1½	....	....	....	....	....	....	16	68	....	....	....	....
Essex Hybrid	2	8	—	—	....	....	—	—	....	....	....	....	....	....	....	....	2	5½	....	....	....	....	....	....	14	57	....	....
58. Potato Leaf	—	—	—	—	....	....	—	—	....	....	....	....	....	....	....	....	1	2½	....	....	....	....	....	....	....	....	....	....
59. Mikado	—	—	—	—	....	....	—	—	....	....	1	1½	....	....	....	....	....	....	3	10½	....	....	....	....	....	....	....	....
Same, From England	—	—	—	—	....	....	—	—	....	....	—	—	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....
Turner Hybrid—Burpee, 1886	—	—	—	—	....	....	—	—	....	....	....	....	....	....	1	4½	....	....	....	....	....	....	....	....	....	....	....	....
Turner Hybrid—Maule	—	—	—	—	....	....	—	—	....	....	....	....	3	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....
60. French Upright	—	—	....	....	—	—	—	—	....	....	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....	....	....
Same, from France	—	—	—	—	....	....	—	—	....	—	—	....	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....
Same, from Prussia	—	—	—	—	....	....	—	—	....	....	1	3	....	....	....	....	....	....	—	—	....	....	....	....	....	....	....	....
61. Station	—	—	—	—	....	....	—	—	....	....	—	—	....	....	....	....	....	....	1	2½	....	....	....	....	....	....	....	....

SYNOPTICAL TABLE.—CONTINUED.

Varieties.—(Concluded from last page.)	Sept. 17.		Sept. 19.		Sept. 20.		Sept. 21.		Sept. 22.		Sept. 23.		Sept. 24.		Total No. of fruits for the season.	Total weight of fruits for the season,—oz.	Weight of plant,—oz.	Average weight of a fruit,—oz.	Ratio of weight of fruit to weight of plant.	No. of days in germinating.	Per cent of germination.
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. green and ripe.	Weight, oz.							
50. Paragon.—*Continued:*																					
Livingston's Perfection											8	30	85	224	110	294	114½	2 3-5	2 1-2	12	96.8
Livingston's Perfection—France											20	76	68	160	102	273	115½	2 3-5	2 3-10	12	92
Autocrat											20	47	87	216	135	323½	106	2 3-10	3 1-20	13	100
Mayflower—Henderson											19	40	71	140	103	205	110	1 9-10	1 4-5	11	100
Mayflower—Root											11	48	59	216	87	289	55	3 3-10	5 1-5	9	86
Mayflower—Prussia											49	60	200	180	347	365½	105	1 1-20	3 1-2	9	82
Scoville—Perry, 1886											11	27	126	240	159	312½	96½	1 9-10	3 1-5	9	97.9
Scoville—Perry, 1887											4	16	90	196	113	277½	98	2 2-5	2 4-5	9	88
51. Optimus									10	32			90	224	108	280½	76	2 1-2	3 3-5	9	78
53. Puritan							30	115					60	188	93	318¼	74	3 2-5	4 3-10	9	98
54. President Garfield											11	48	62	300	76	370	105½	4 4-5	3 1-2	16	84
55. Peach											60	80	314	208	400	323½	102	1 3-5	3 1 10	13	90
56. Feejee									27	68			55	128	87	213	44	2 2-5	4 4-5	12	78.5
Same, from Prussia											12	20	101	192	139	258½	77	1 4-5	3 3-10	11	78
57. Acme—Henderson											19	44	64	92	129	257	72	1 9-10	3 1-2	16	42
Same, from Gregory													70	128	103	254½	52	2 2-5	4 4-5	16	73.3
Same, from England	9	40											64	200	76	254	58	3 1-5	4 3-10	13	90
Same, from France					14	76					14	68	133	312	163	467	104½	2 4-5	4 2-5	15	66
Same, from Prussia									22	88			68	204	94	307	69½	3 1-5	4 2-5	20	20
Rochester Favorite											11	11	94	112	100	135	58	1 3-10	2 3-10	15	75
Rochester Favorite—Gregory											13	58	50	196	69	277	59½	4	4 4-2	16	83.3
Livingston's Beauty—Sibley									15	30			43	108	64	152	39	2 3-10	3 4-5	20	82
Livingston's Beauty—Rawson											22	58	68	136	96	204½	70	2 1-10	2 9-10	16	88
Climax—Livingston											22	62	70	132	100	216	48½	2 1-10	4 2-5	20	73.3
Hovey—Thorburn, 1886											22	58	57	108	91	190	48	2 2-25	3 9-10	20	68
Hovey—Thorburn, 1887											12	44½	85	216	114	330	74	2 4-5	4 2-5	16	94
Essex Hybrid													81	196	99	266½	53½	2 3-5	4 9-10	14	92.8
58. Potato Leaf					18	104							75	228	94	334½	88	3 1-2	3 4-5	10	74
59. Mikado									13	72			64	344	81	428	75½	5 1-5	5 3-5	13	92.3
Same, from England									15	32			29	124	44	156	25	3 1-2	6 1-4	11	78
Turner Hybrid—Burpee, 1886							15	67			—	—	46	168	62	239½	116	3 9-10	2 3-50	13	91.6
Turner Hybrid—Maule							7	37			—	—	80	316	90	362	74½	4 1-50	4 1-2	12	84
60. French Upright					—	—							6	12	6	12	23	2	1 2-23	11	44
Same, from France									4	21			14	32	18	53	36	2 4-5	1 2-5	13	64
Same, from Prussia									3	16			16	52	20	71	35	3 1-2	2 1-50	19	12
61. Station									—	—			13	20	14	22½	17	1 3-5	1 3-10	23	14.3

TABLE, 1886.

Variety.	Productiveness.		Ratio of fruit to plant.
	Plant. Lbs.	Fruit. Lbs.	
From Peter Henderson & Co.:			
Queen	7¼	17½	2 2-5
Hathaway's Excelsior	13½	22½	1 3-5
General Grant	10¾	25¾	2 3-10
Cardinal	12	13	1 2-25
Conqueror	7	19	2 7-10
Mayflower	10	16½	1 3-5
Mikado	8½	25½	3
Paragon	9¼	14½	1 14-25
Perfection	10½	16	1 13-25
Trophy	6½	17½	2 7-10
Golden Trophy	13¾	21	1 1-2
Trophy, extra selected	14¼	24¼	1 7-10
Vick's Criterion	9¾	19	1 9-10
Canada Victor	7¾	22½	2 9-10
Acme	11¼	21	1 4-5
Livingston's Favorite	9¼	12¼	1 3-10
Pear Shaped	13½	10	37-50
Island Beauty	10¾	17¼	1 3-5
Green Gage	12½	22	1 7-10
Essex Hybrid	8	19¼	2 2-5
Yellow Plum	9½	16	1 17-25
Feejee Island	9	18¾	2 2-25
Red Cherry	16¼	11	67-100
From J. M. Thorburn & Co.:			
Hundred Days	6	19	3 1-10
Red Valencia Cluster	8	19½	2 2-5
Hovey	14¼	18	1 1-5
Improved Large Yellow	7¼	7½	1 3-100
Yellow Cherry	20½	10¾	13-25
New Currant	6⅛	9¾	1 1-2
Alpha	8½	16¾	1 14-25
Read's Island Beauty	10½	19¾	1 4-5
From James J. H. Gregory:			
Livingston's Acme	12¾	20	1 24-25
The Cook's Favorite	8¾	18¾	2 1-10
Fulton Market	6	13½	2 1-5
Yellow Victor	10	21½	2 3-20
New Red Apple	9	17½	1 9-10
Tilden's New	10	18	1 4-5
Essex Round Red Smooth	10½	21	2
Rochester Favorite	7¼	17¼	2 1-5
Criterion	10¼	19	1 4-5
From the A. C. Nellis Co.:			
Nellis' Snowball	14¼	10¼	7-10
Queen	12	15½	1 29-100
New Cardinal	12	17¾	1 12-25
New York Market	11	15½	1 2-5
Nisbit's Victoria	7¼	25½	3 1-2
Persian	12	16½	1 3-10
Precursor	7	19¾	2 4-5
Nellis' Selected Trophy	9¼	13¾	1 12-25
From W. W. Rawson & Co.:			
King Humbert	11	21¾	1 9-10
Boston Market	7¾	18½	2 3-10
Tom Thumb	7½	15½	2 3-50
Golden Queen	13¾	22¾	1 3-5
Livingston's Beauty	5½	14½	2 3-5
Golden Trophy	11¼	22½	2
Emery	8½	9½	1 1-10
Climax	8	18¼	2 7-25
From Hiram Sibley & Co.:			
Rochester	11¼	16¾	1 12-25
Large Red Smooth Round	7	20½	2 9-10
Dwarf Orangefield	14¾	17¼	1 9-50
Autocrat	16½	27	1 4-5
Cardinal	16¼	22½	1 8-25
Livingston Favorite	8¾	17	1 9-10

TABLE, 1886.—CONTINUED.

Varieties.	Productiveness.		Ratio of fruit to plant.
	Plant. Lbs.	Fruit. Lbs.	
From W. Atlee Burpee & Co.:			
Golden Queen	10¾	16¼	1 1-2
Turner Hybrid	12½	21½	1 7-10
From Robt. Buist:			
The Prize Belle	14	25	1 3-5
From Frank Ford & Son:			
Market Champion	9	16	1 7-10
Advance	8½	15¾	1 17-20

An experiment was made on tomatoes at this College in 1870 by Prof. A. N. Prentiss. In order to compare the results obtained at that time with those recorded in the foregoing tables, I have condensed the records of those varieties which we have also grown and present them in the following table :

Variety. (Notes based upon six plants of each.)	Aug. 15.		Aug. 18.		Aug. 22.		Aug. 25.		Aug. 29.		Sept. 6.		Sept. 13.		Sept. 19.		Total ripe fruit.		Total green fruit Sept. 19.		Total yield, six plants.		Average date of ripening.	Average weight of fruit in ounces.	Average fruit to a plant.	
	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No. ripe.	Weight, oz.	No.	Pounds.	No.	Pounds.	No.	Pounds.			No.	Pounds.
General Grant	1	3½	1	7½	7	21	3	12	10	33	42	202	103	312	152	472	319	65.33	72	13¼	391	79.3	Sept. 15	3.3	65.1	13.2
Tilden	----	----	----	----	4	27½	2	8	9	32	21	75	87	372	179	632	302	71.7	119	23¼	421	95.	Sept. 16	4.3	70.1	15.8
Hubbard's Curled Leaf	6	19½	13	39	22	68	11	30	10	45	131	450	365	872	287	632	845	134.7	116	13¾	961	148½	Sept. 13	3.3	160.1	24.7
Keyes	----	----	----	----	4	6½	3	9	1	4	50	127	121	328	206	512	385	61.6	273	31¾	658	94⅓	Sept. 17	2.7	109.7	15.7
Cedar Hill	----	----	----	----	----	----	----	----	1	1	21	86	107	315	102	390	231	49.5	137	27⅜	371	76.9	Sept. 16	3.6	61.8	12.8
Apple Shape	----	----	2	4½	2	5	3	13	8	25	30	128½	71	244	134	540	250	60.	115	37½	365	97.5	Sept. 16	3.5	60.8	16.2
Boston Market	----	----	8	18	12	40½	6	21	10	22½	85	305½	187	652	169	468	477	95.5	82	13	559	108½	Sept. 13	3.7	93.2	18.1
New York Market	2	3½	1	2½	3	6	----	----	2	5½	42	130½	90	264	181	560	321	60.7	354	46¾	675	107½	Sept. 17	3.1	112.5	17.9
Red Valencia Chester	----	----	----	----	----	----	1	4	----	----	13	54	47	252	150	524	311	50.9	260	56¾	471	107⅔	Sept. 18	5.1	78.5	17.9
The Cook's Favorite	1	1¾	1	2	3	2	7	15	6	14½	66	140½	148	332	190	376	422	55.3	429	34¾	851	90.	Sept. 16	2.3	141.7	15.
Orangefield	----	----	3	4	4	16	2	3	----	----	31	87	74	240	150	301	264	40¾	455	57.6	719	98⅓	Sept. 17	2.7	118.2	16.4

small, berry-like fruits of the Cranberry to the delicate and slender ones of the Red Cluster, the monstrous and irregular Bell varieties, and the singular tomato-shaped sorts, there is a variation so great that one cannot avoid seeking for different specific origins for each type. Yet closer study reveals the fact that nearly every form is connected with others by an almost complete series of gradations. The variety which is the least connected with others is the Red Cluster. (Fig. 12.) Four reputed species of pepper are said to enter into our garden varieties—Capsicum annuum, C. frutescens, C. grossum, and C. cerasiforme. I am entirely unable, however, to distinguish these species in the garden varieties which we have grown, and must therefore for the present refer them all to Capsicum annuum. As an instance of the variation in peppers, I cite the following: A plant of the large Bell or Bull Nose last year produced some fruits which were long, regular and slender, much like an over-grown Cayenne. If these fruits had grown on different plants they would have been called, unhesitatingly, distinct varieties. They were entirely unlike in form. Seeds were saved, and this year planted, from a well-formed fruit of each sort. The seeds from the Cayenne-like fruit reproduced their parent very closely, but the seeds from the typical Bell produced plants which gave fruits of various shapes. The greater number of the fruits from this latter seeding were the same as the Cayenne-like fruits of the former seeding, while some plants gave true Bell peppers. This experiment proves how easy a matter it is to produce new varieties and how seeds may become "mixed" without any fault of the seedsman. Half the varieties which we grew this year presented one or more untrue plants. It is reasonable to suppose that at least some of these mixed sorts were the products of unmixed varieties. This experiment also proves that the so-called species of pepper are not widely separated. The Cayenne is usually referred to Capsicum frutescens and the Bell to C. grossum, yet the distinctive forms of each are produced on the same plant and are perpetuated by its seeds. The reversion of the offspring of the Bell to the Cayenne-like type suggests the origin of the Bell from the slender sorts, the same as the large market tomato must have sprung from the cherry and plum sorts. The critical observer of the variations in peppers will not need the results of this simple experiment to convince him that the monstrous Bell varieties are but developments from smaller and more pointed sorts. The leaves and the habits* of the plants are also various between the different varieties. How much hybridization has had to do with all this variation, it is, of course, impossible to determine.

I. CHERRY PEPPERS.—*Fruit mostly globular and regular, berry-like, small* (one inch or less in diameter).

1. *Cranberry.* (*Airelle rouge* of Vilmorin. See No. 4). Plant diffuse, a foot high; leaves ovate (blade three-fourths of an inch wide by one and half inches long); fruits erect, very small (one-half inch or less in diameter), brigh red.—From Peter Henderson & Co. One plant, September 3, bore three ripe fruits, and another bore one.
2. *Red Cherry.* (*Cerise* of Vilmorin.) Plant more upright than the last; fruits mostly drooping, sometimes flattened on the end, three-fourths of an inch in diameter, becoming black, then bright red. From Joseph Breck and Son, and Vilmorin-

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* See Figs. 12 and 13.

Andrieux et Cie. Sept. 3 three plants from Breck gave one ripe fruit each, while there were no ripe fruits on plants from Vilmorin.

3. *Oxheart.* Plant diffuse, robust; fruits drooping, variable, mostly short oblong-conic, much like a beef's heart in shape, an inch to an inch and a half long, bright red.—From Isaac Tillinghast. Sept. 3 four plants had produced, altogether, six ripe fruits.

4. *Red French.* Much like the last, but the fruits more pointed and somewhat furrowed.—From Vilmorin-Andrieux et Cie. This proposed variety came in the sowings of *Airelle rouge* "red whortleberry." Most of the plants in the sowing bore fruits like the *Cranberry*, and it is probable that such is intended by the variety *Airelle rouge* of Vilmorin-Andrieux et Cie. The sort which is here called *Red French* probably came of some impurity in the seed.

II. LONG PEPPERS.—*Fruit very slender or several times longer than broad, tapering gradually to a point, not furrowed.*

A. Fruits red.

5. *Red Cluster.* (*Bouquet rouge* of Vilmorin.) Plant very compact and upright, a foot high; leaves narrow, almost lanceolate (blade three-fourths of an inch wide by two and one-quarter inches long); fruits borne in clusters, erect, very slender (one-quarter inch or less in diameter by two to two and one-half inches long), sharply pointed, usually crooked near the end, very light bright red. Fig. 12.—From W. Atlee Burpee and Vilmorin-Andrieux et Cie. This variety is the most distinct of any we grew. It is very handsome, and is worthy a place among ornamental plants. A few fruits were ripe Sept. 1. The plants from French seed were a little earlier.

6. *Chili.* Plant compact; leaves shorter than in the last (blade nearly three-quarters of an inch by one and one-half inch); fruit usually erect, straight, firm, about two inches long by one-half inch broad at base, blunt on the tip, becoming black before maturity, when it assumes a rich red.—From Vilmorin-Andrieux et Cie. Several fruits were ripe Sept. 1. The *Small Chili*, from J. B. Root & Co., gave very variable fruits, some being almost berry-like and others like the *Chili* in shape.

7. *Cayenne.* Plant and leaves much as in the last; fruits drooping, mostly curved, three to four inches long by a half or three-quarters inch broad at the base, mostly somewhat bluntish on the tip, rich red.—From Vilmorin-Andrieux et Cie. Sept. 3 two plants had two ripe fruits each.

B. Fruit yellow.

8. *Long Yellow Cayenne.* Fruit much like that of No. 7 in shape, but thicker and tending to crook, light bright orange.—From Peter Henderson and Co. Sept. 3, one plant bore seven ripe fruits, another five and three others two each.

9. *Long Yellow French.* (*Jaune long* of Vilmorin.) Plants stouter than No. 8; fruits much larger, often five inches long, tending to become broad and furrowed.—From Vilmorin-Andrieux et

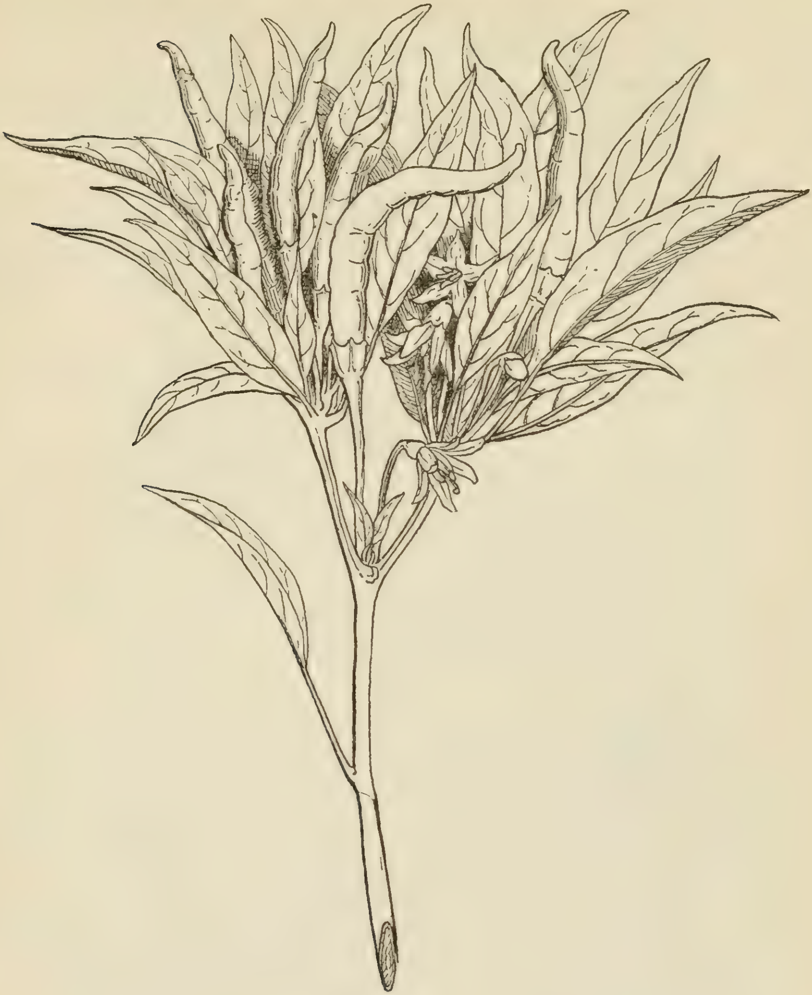

FIG. 12.

Cie. Sept. 3, one plant bore one ripe fruit and another bore one nearly ripe.

III.—BELL PEPPERS.—*Fruit large, long, oblong, or oblong-conic, variously furrowed or irregular, broad and truncate at the base, feeling as if somewhat inflated. Plants large and coarse.*—The so-called sweet peppers.

A. Fruit red.

10. *Long Red* of Vilmorin. (*Rouge long ordinaire.*) Plant tall and robust; fruit long (four inches long by one to one and a half inches broad at base), somewhat irregular, but not furrowed lengthwise, somewhat curved.—From Vilmorin—Andrieux et Cie. Very late. This connects the Long peppers

with the Bell Peppers, and perhaps should be classed with the former. It is evidently too irregular to be the same as the *Long Red* of Burr's Vegetables of America, p. 611.

11. *Red Cardinal.* Much like the last, but the fruit somewhat shorter and blunt or truncate and variously lobed at the tip, and lightly furrowed lengthwise.—From W. Atlee Burpee. Very late.
12. *Giant Emperor.* Plant very strong and vigorous; leaves very large (blade three inches by five inches); fruits various, varying from broadly conical to long pointed-oblong (from two and a half inches broad by three and a half inches long, to one and

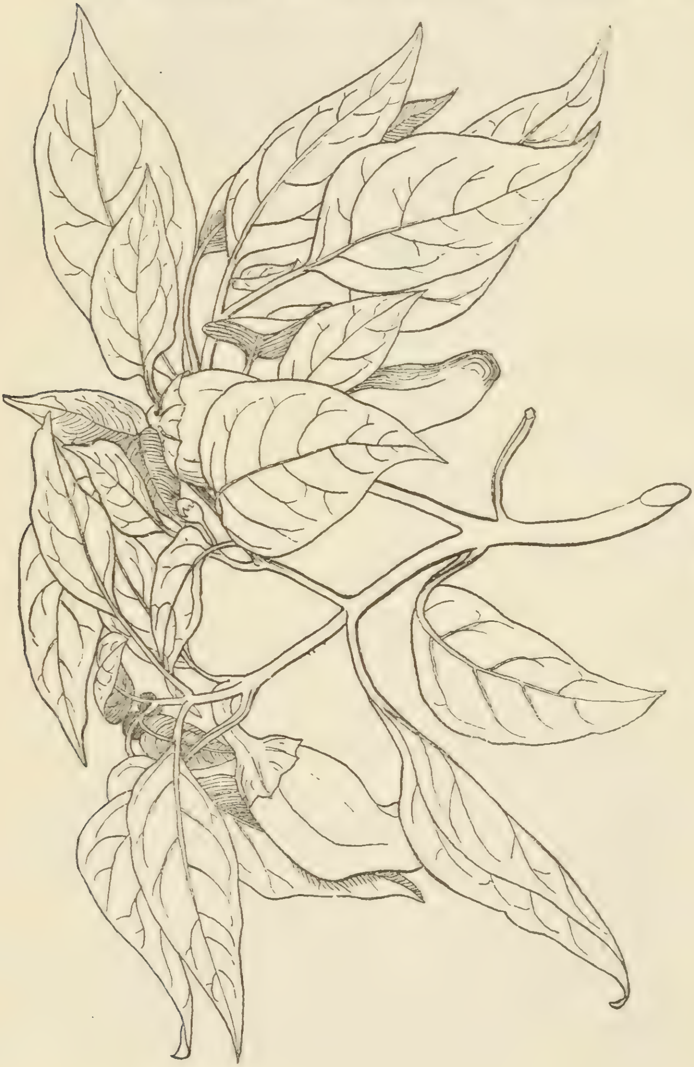

FIG. 13.

a half inches broad by five inches long), slightly furrowed.—From Peter Henderson & Co. Very late. Henderson's character, "a quarter of an inch thick," is evidently a mistake. Fig 13 shows this variety with immature fruits.

13. *Pimiento Dulce.* (*New Sweet Spanish.*) Plant very robust; foliage dense and heavy; fruit long, large, and slightly furrowed (two to three inches by four to five inches); variable.—From Peter Henderson & Co. Very late.
14. *Bell.* (*Bull Nose. Carré doux d'Amerique,* "American Sweet Square," of Vilmorin.) Plant large and robust; fruits short-conic, or as broad as long, much lobed near the end and variously furrowed (varying from two inches broad by two and a half long to three inches broad and three and a half inches long).—From Vilmorin—Andrieux et Cie. Late.
15. *Ruby King.* Most of the plants smaller than in No. 14, otherwise indistinguishable. The fruits did not ripen.—From J. B. Root & Co.
16. *Sweet Spanish.* Appears to differ from No. 14 only in the smaller size of the plants. This and No. 14 appear to be indistinguishable.—From Peter Henderson & Co. Very late. The *Sweet Spanish* (*Doux d'Espagne*) of Vilmorin is not the same. Its fruits are also late, but more like those of Red Cardinal.
17. *Sweet Mountain.* Differs from No. 14 by its larger fruits which are mostly short-oblong and very blunt or squared and lobed at the tip (two to three inches broad and three to four inches long), strongly furrowed. Said to be milder than the *Bell.*—From J. B. Root & Co. Medium.

B. Fruit yellow.

18. *Yellow Bell.* (*Golden Upright* of Burpee, *Golden Dawn Mango, Golden Queen* of Tillinghast, *Carré jaune hatif* of Vilmorin.) Plant loose in habit, strong, medium in height, leaves large; fruits like the *Bell,* only usually more regular, not so deeply furrowed, bright yellow or orange.—From W. Atlee Burpee, James J. H. Gregory, J. B. Root & Co., Isaac Tillinghast, Vilmorin-Andrieux et Cie. Beginning to ripen September 1.

IV. TOMATO-LIKE PEPPERS.—*Fruit flattened, broader than long, mostly nearly regular on top.*

19. *Squash.* (*Boston Squash, New Dwarf Early Red Squash, New Red Squash, Tomato nain hatif.*) Plants medium in growth, leaves large; fruits various, sometimes tending towards the shape of the *Bell,* angled on the sides, two to three inches across, dull red.—From James J. H. Gregory, W. Atlee Burpee, J. C. Vaughan, Vilmorin-Andrieux et Cie. September 3, two plants from Gregory gave together two ripe fruits; five from Burpee gave together five ripe fruits; seven from Vaughan gave ten ripe fruits; five from Vilmorin gave eight.
20. *Red Tomato.* (*Tomato rouge* of Vilmorin.) Much like the last, but later, and the fruits more angled, and more furrowed about the base.—From Vilmorin-Andrieux et Cie.

NOTE.—*Monstreux* and *Gros carré daux* from Vilmorin-Andrieux et Cie, were so inconsistent in character of fruit that places could not be assigned them in this synopsis.

III. NOTES ON ONIONS.—Fifty-three named varieties of onions were grown in the College garden this year. All the American black-seed varieties and all offered by F. & A. Dickson and Sons of Chester, England, were grown. In addition we grew potato onions, garlic, Welsh onion, etc. One of the most obvious and curious features connected with this experiment was the very tardy ripening of nearly all the varieties of England. There was a difference of two or three weeks, or even more, in the periods of ripening between some varieties grown from American seeds and the same grown from English seeds. This difference was especially noticeable in the case of the Yellow Danvers and Red Wethersfields, both varieties of American origin.

It is impossible to draw definite conclusions from one year's experience. The following synopsis is therefore but a preliminary and provisional one. There is no attempt made in it to describe or characterize varieties. The notes are mostly of a general nature, though taken directly from the onions themselves. The season has been so very dry that many varieties have, no doubt, not been characteristic. There are no permanent characters which can be used with much satisfaction in the construction of a classification of common onions.

For market sorts we were most pleased with Red Wethersfield (No. 27 of the following synopsis), Yellow Danvers (33), Early Yellow Cracker (37), Silver King (4), and Giant Rocca (13). For house use the following appeared to be the best: Extra Early Red (25), Early Pearl (5), Yellow Strasburg (31), Queen (9), Yellow Danvers (33). As a rule, the English sorts appear to possess no value for this country.

PRELIMINARY SYNOPSIS OF ONIONS AND SOME OF THEIR ALLIES:

A. *Leaves flat or canaliculate, not hollow.*

1. GARLIC, ALLIUM SATIVUM *Linn.*—One of the most pungent of the onion tribe. The plant rarely seeds in cultivation, and is therefore exclusively propagated by the small bulbs of which the main bulb is composed. It is propagated the same as set onions. It matures in early September here, and is stored and handled the same as onions.—From D. M. Ferry & Co.

2. LEEK, ALLIUM PORRUM *Linn.* Much prejudice exists in this country concerning this plant, probably from associating it with the unsavory wild leek of new pastures and woods. It bears no resemblance to this wild plant, however, in odor or flavor. In fact, the leek is milder than most onions. It is a very agreeable seasoning in soups and other dishes. It demands more attention from those who enjoy good vegetables. For ordinary purposes its culture is about the same as that of the black seed onions. It matures very late in the fall, and may be allowed to stand until after severe frosts become common. The plant produces scarcely any distinct bulb.

B. *Leaves more or less cylindrical, hollow.*

3. CHIVES OR CIVES, ALLIUM SCHŒNOPRASUM *Linn.*—This plant is a perennial, growing in thick tufts, and attaining a height of six or ten inches. Although it flowers here profusely it rarely produces seeds, and is therefore propagated by divisions of the tufts. The leaves are used for seasoning various dishes, and they may be cut at almost any time during the year. Chives may be planted along a fence or path, where it will form an edging, and be out of the way of the plow. It grows wild on

the northern shores of Lake Huron, and about Lake Superior and northward, although it was brought into cultivation from Europe.

4. WELSH ONION, ALLIUM FISTULOSUM *Linn.*—This plant is very similar in appearance to a vigorous scullion. Our specimens were still growing vigorously September 16. It is ordinarily propagated by seeds the same as onions, although it may be propagated by division of the stems. It does not produce bulbs. The leaves are used for seasonings.—From England.

5. COMMON ONION, ALLIUM CEPA *Linn.*

Series I. Propagated by division. This series includes the various potato onions, multipliers, etc. They demand no extended notice at this time.

Series II. Propagated by bublets or "tops." The familiar "top onions," tree onions, Egyptian onions, etc.

Series III. Propagated by seeds (*or sets*).

A. Skin of the mature bulb SILVERY WHITE.

**Globe onions*,—the bulb normally spherical.

1. *Southport White Globe.* Medium in size, typical specimens nearly round, very firm. Uneven in size and shape, many specimens being nearly flat.—From J. B. Root & Co. and J. C. Vaughan (*White Globe*).

***Flat onions*,—the bulb normally more or less flattened horizontally.

a. Bulbs large, averaging three and a half inches or more across. Late growers, mostly with thick necks.

2. *White Italian Tripoli.* Inclined to be globe-form and double. Irregular in shape. Very large. Still growing, September 16. —From England.

3. *White Lisbon.* Smaller than the last, more flat on the bottom; otherwise scarcely distinct.—From England.

4. *Silver King.* Well grown specimens five inches in diameter, mostly very flat and thin and very white. Variable in size. Appears to mature well and to be valuable.—From Maule and Tillinghast.

5. *Extra Early Pearl.* Much earlier and considerably smaller than the last; otherwise very similar.—From Maule.

6. *El Paso* (*Large Mexican*). Medium to large, very flat, running even in shape, early.—From Ferry.

7. *Extra Early Bloomsdale Pearl.* Indistinguishable from the last.—From Landreth.

8. *White Portugal* or *Silver Skin.* Scarcely smaller than No. 6, running very uneven in size, some of the bulbs maturing very early. Apparently mixed, but the best bulbs are very handsome in shape.—From Root and England.

b. Bulbs small, seldom over two inches across.

9. *Queen.* A fine small and very early clear white onion, shapely, even in size. Onions of the Queen type are usually somewhat indented or scalloped on the edges, and they are usually borne conspicuously on the surface of the ground. The tops are small and slender and the roots few.—From England.

The *New Queen* from Root is evidently the same, but it runs smaller, not so flat nor handsome.

10. *Nocera.* Small, one to two inches across, the edges conspicuously scalloped, but evidently not distinct from the last.—From England.
11. *Neapolitan Marzajola.* Evidently the same as the last two.—From Root.

B. Skin of the mature bulb COLORED.

**Globe onions.* The colors of all these globe sorts are neutral or indifferent. They are mostly browns and yellow-reds. There are no distinctly red sorts among them.

12. *Yellow Globe.* Medium to large, running very regular, tapering both ways, dull reddish-yellow.—From England.
13. *Cranston's Excelsior.* Differs from the last only in color which is a distinct light-reddish straw-color.—From England.
13. *Giant Rocca.* (*Giant Rocca Tripoli.*) An immense onion, probably the best of the Italians for this country. Ordinary bulbs this dry season weighed ten ounces. In color it varies from yellowish-white to dull red. A dull yellow appears to be the normal color.—From England.

    The same from Root was smaller and more uneven in size, not desirable.
14. *Golden Ball.* (*Landreth's Golden Ball.*) Evidently not distinct from the Rocca, although many specimens are much too flat for the type of that variety. The largest bulb weighed eight ounces. The tops were still green Sept. 16.—From Landreth.
15. *Large Globe Tripoli.* Smaller than the Rocca from English seed, flatter and darker colored. Perhaps not distinct.—From England.
16. *Trebons.* Medium in size, flattish, reddish-brown, even in size, the neck very large. In England it is said to grow to an immense size. It did not mature here.—From England.
17. *James's Keeping.* A flattish-oval onion which did not mature. Bulbs dull red or yellowish-red. It produced very few good bulbs.—From England.
18. *Brown Spanish or Portugal.* Medium to small in size, flattish, red-brown. The bulbs did not all mature.—From England.
19. *Bedfordshire Champion.* A well-formed globe onion, of undersize as grown with us, red-brown. Did not mature.—From England.
20. *Brown Globe.* A well-formed globe, reddish-brown. Did not mature.—From England.
21. *Zittau.* (*Mammoth Zittau.*) A flattish globe, yellow or reddish-yellow. Did not mature, although some bulbs measured three inches across.—From England and Tillinghast.
22. *Nuneham Park.* Flattish globe inclining to the form of true flat onion, light yellow, even in size, handsome. Did not mature, although three inches in diameter of bulb.—From England.
23. *Rousham Park Hero.* A well-formed flattish globe, white-yellow, three inches in diameter, but did not mature.—From England.
24. *White Globe.* Variable in shape, usually a flattish globe, whiteish-yellow, three inches in diameter. Handsome in shape. Did not mature.—From England.

***Flat Onions.*

a. Bulbs deep and distinctly red.

25. *Extra Early Red.* Small to medium (reaching two and a half inches in diameter), regular in shape, very early. Apparently one of the very best early.—From Root.
26. *Early Red Globe.* Medium in size, tending to globe-shape on top, regular and handsome, early. Much thicker than the last; also larger. Evidently a slight departure from Wethersfield.—From Root.
27. *Red Wethersfield.* Too well known to need description. Grown from English seed, it was larger than from American seed and was not ripe Sept. 16. "In its original form the bulb was quite spherical but at the present day it is seldom found, even in America, without having the ends somewhat flattened, and wherever the primitive form occurs it is known as the Large Red Globe."*—From England and Root.
28. *Early Flat Red.* Indistinguishable from Wethersfield.—From Vaughan.
29. *Early Round.* Indistinguishable from Wethersfield.—From Vaughan.
30. *Blood Red.* Medium to large, tending to globe-shape above. Not yet ripe (Sept. 16). Evidently not distinct from Wethersfield.—From England.

b. Bulbs indifferent in color,—reddish and yellowish.

31. *Yellow Strasburg.* Small, even in shape, uneven in size, very pale yellow, very early. Desirable for home use.—From Vaughan.
32. *Pale Red Bermuda.* Small, varying from flat to somewhat globe-shaped, uneven in size, light chocolate-red, very early.—From Henderson.
33. *Yellow Danvers.* Too well known to need description. "It is an American variety, and when first introduced into France (about 1850) was quite spherical in shape, but now it grows almost always more or less flattened, not only in European gardens, but also in its native country."†—From Root and England.
34. *Flat Yellow Danvers.* Tending to grow larger than No. 33, and more inclined to assume a globe form.—From Vaughan.
35. *Yellow Danvers Globe.* Indistinguishable from Yellow Danvers. —From Root.
36. *Nasbey's Mammoth.* Averages somewhat larger and later than Danvers, but cannot be distinguished from the Danvers grown from English seeds.—From Gregory.
37. *Early Yellow Cracker.* A fine onion of uniform size and shape, averaging considerably larger than Danvers from American seeds, ripening evenly. Evidently a good selection from Danvers.—From Gregory.
38. *Banbury Improved.* Medium in size, tending to globe shaped above, straw yellow. Not ripe September 16.—From England.

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* Robinson, The Vegetable Garden, 369.

† Robinson, The Vegetable Garden, 365.

39. *White Spanish, Portugal* or *Reading.* Indistinguishable from the last.—From England.
40. *Dickson's Defiance.* Medium in size, tending to be globe shaped above, regular in size and shape, straw yellow. Matured much like Danvers, but more globe-like. Does the best here of the English sorts.—From England.
41. *Deptford* or *Strasburg.* Medium, tending to become globe shaped above, reddish brown, mostly matured.—From England.
42. *Mammoth Pompei.* Very large, very flat, five inches across, good specimens weighing seven ounces, light chocolate brown. It matured well, and gives promise.—From Tillinghast.
43. *Red Italian Tripoli.* Much like the last, but a little darker in color, not so even or large in size. The largest specimen weighed eight ounces. Mostly matured.—From England.
44. *Large Flat Tripoli.* Scarcely distinguishable from Mammoth Pompei, but averaging larger.—From England.

IV. NOTES ON STRAWBERRIES.—The strawberry crop this year was heavy. We had an opportunity to form a satisfactory judgment upon many varieties with which we had formed no intimate acquintance before. For general purposes as market berries those which pleased us best are Sharpless, Lower, Manchester, Crescent, Champion.

In the following synopsis, only such varieties are characterized as fruited with us this year in sufficient abundance to enable us to form a judgment concerning them. The notes are in every case condensed from those taken in the field. On most varieties notes were taken two or more times, and the quality of fruit was carefully tested in every case.

It is an exceedingly difficult matter to construct a satisfactory classification for strawberries. There are almost no salient and comparatively constant marks of distinction. The best that can be done in the present case is to adopt the classification which follows. The varieties themselves are characterized by contrasting similar points, and always in the same order, as follows:

1, habit; 2, foliage; 3, trusses; 4, berry: *a*, size; *b*, shape; *c*, color; *d*, texture; *e*. flavor; 5, general remarks.

CLASS A.—*Berries small, mostly elongated; pips not sunken into the flesh of the berry; trusses mostly higher than the leaves; plants small, rather delicate.—Products of Fragaria vesca* and *F. elatior,* never grown for market in this country.

Alpine Wood,
Belle Bordelaise,
Royal Hawtbois, etc.

CLASS B.—*Berries large; pips more or less sunken; trusses mostly lower than the leaves; plants large and mostly hardy.*—Products of *Fragaria Virginiana* and supposed hybridizations with *F. Chilensis.* Market sorts.

SECTION I.—Berries produced into a distinct neck or collar at the base. Flowers all perfect, unless in Hathaway No. 5, in which the stamens are scarcely recognizable.

Bidwell.—Medium to high; foliage strong, rather light in color; trusses long but weak; berry medium, long-conic, bright dark red, firm, good in quality. Berries do not ripen evenly. Not desirable for general culture.

Crystal City.—High; foliage good, light-colored; trusses high and erect; berry small to medium, short-obovate, very light red, rather soft, sweet. Unproductive. Not worth cultivating.

Glendale.—Medium to high; foliage luxuriant, dark; trusses nearly erect; berry medium to large, long-conic, with a very large calyx, firm, color not clear, quality medium to poor, rather late. Not productive. The first berries ripened June 14; the last good berries were procured a week later. Gives little promise with us. It was grown on rich sandy soil.

Howell.—Belongs in this section. Has fruited but one year with us.

Hathaway No. 5.—High, loose; foliage light-colored; trusses branching very low, the branches long and weak; berry very long-conic or long-oblong, almost finger-shaped, light red, rather firm, medium in quality. Curious rather than valuable. A rampant grower.

Mrs. Garfield.—Medium to high; foliage rather dark; trusses rather stout; berry medium, short-conic, the neck very short, very bright, light red, moderately firm, fair to good in quality. Of no especial importance.

Nigh (*Nigh's Superb*).—Medium to low; foliage good, light colored; trusses nearly prostrate; berry medium, oblong-elliptic or obovate, light colored, rather soft, sweet. Evidently not desirable.

Nobe (*Nobe's Seedling*). Medium; foliage dark; trusses moderately strong; berry medium to small, short-obovate, rather dark, very firm, ripens unevenly, fair in quality. Evidently not desirable.

Shirts—Medium; foliage rather light in color; trusses weak; berry medium to small, conic, light colored, soft, poor. This berry is described as possessing a high flavor and fine color. Ours answers to anything but such characters. It may not be true to name.

SECTION II.—Berries not produced into a neck. Some varieties, as Jewel and Sharpless, are somewhat tapered and smooth at the base, but can hardly be said to have a neck.

Group 1. Flowers perfect.

Alley's No. 9.—Medium; foliage good; trusses middling stout; berry large, broad-ovate; color good; firm, fair in quality; calyx large. Evidently a good berry.

Atlantic—Low to medium; foliage good, very dark; trusses weak, the branches long; berry medium to large, conic, very dark, and glossy in color, rather firm, rich when fully ripe; colors evenly for a dark berry. Not productive with us. Of some promise.

Black Defiance—.High to medium, loose; foliage very large, dark; trusses weak; berry medium to large, ovate, or becoming very broad, dark and rich in color; firm, first-class in quality. A good berry.

Captain Jack.—Medium; foliage very dark; trusses erect; berry medium, nearly round; light, but bright in color, rather soft, fair in quality. Possesses no decided merits.

Cowing.—Medium to high; foliage heavy, light colored; trusses rather strong; berry medium to large, flattish; rather too light in color; rather soft, sweet and good. A desirable berry.

Downing.—Medium to high; foliage good, light-colored; trusses high, mostly erect; berry medium to small, short-conic, light in color, rather soft, fair in quality. Of average merit.

Duncan.—Medium, not much inclined to spread; foliage good, dark; trusses rather low; berry medium to small, nearly spherical, smooth and regular, the calyx fitting closely, dark and attractive in color, rather soft, excellent in quality, not very productive. A good dessert berry, of easy management.

Finch (*Finch's Prolific*).—Medium; foliage good, very dark; trusses stout and high; berry medium to large, round, light-colored, rather soft, fair in quality. A good berry, though not superior to many other sorts. Much like the Manchester, but trusses higher.

Great American —Medium to high; foliage good, medium in color; trusses rather weak; berry large to very large, conic, very light in color, soft, poor. Undesirable.

Hart's Minnesota.—Medium; foliage good; berry medium to large, conic, good in color, firm, good, evidently productive. Very promising.

Heffner's No. 1.—Medium; foliage large, very abundant; trusses weak; fruit medium, short, ovate, bright, rather firm, the pips much sunken, good. Promising.

Henderson.—Low; foliage pretty good, dark; trusses low but stout; berry small, short, conic, bright, sweet. Of no value. Our stock is from Peter Henderson & Co., but the berries bear no resemblance to the figure of the Henderson in Henderson's *Gardening for Profit*, new ed., 329.

Kentucky.—Very high; foliage strong, light-colored; berry medium to large, conic, light but even in color, firm, good, late. Only moderately productive. Perhaps the best of the late berries.

Longfellow Improved.—Low; foliage fair, dark; trusses low, rather weak; berry medium to small, long-oblong, very poor in color, soft, fair to poor in quality. Ripens unevenly. Stock from Peter Henderson & Co. Of no value.

Lower.—High, vigorous; foliage abundant, rather light; trusses stout; berry large to very large, round, bright dark red, rather soft, excellent in quality, productive. One of our very best berries for close markets. Originated with Mr. Byron Lower at Mt. Pleasant, Mich. Not disseminated. It has been grown here since 1882.

Maggie.—Low; foliage good, very dark; trusses weak; berry medium, conic, good in color, soft, fair to good. Indifferent. Not sufficiently tested.

May King.—Medium; foliage good, medium in color; trusses rather weak; berry medium, conic, light but even in color, rather soft, productive. Promises well.

Miner.—Medium to low; foliage good, dark; trusses strong; berry large, round to round-conic, very dark, coloring unevenly, rather soft, good. Heretofore the Miner has been one of our best berries, but it has not done well this year. It has colored more unevenly than usual. It picks hard.

Mt. Vernon.—Medium to high; foliage vigorous; berry medium to large, conic or round, rather light but even in color, soft, the core pulling out easily, good, late. A handsome late berry, good for home use or market.

Parry.—Medium; foliage good to scant; trusses low; berry medium, short-conic, poor in color, rather firm, fair to good. Disappoints us.

Piper.—High to medium; foliage strong, light-colored; trusses rather weak; berry medium to small, very short-conic, or round, dark, soft, very poor. Of no value.

President Lincoln.—Medium; foliage good, light; trusses weak; berry large to medium, round, very dark, rather firm, good. Berries uneven in size. Of no superior merit.

Sharpless.—Medium to high; foliage strong; trusses strong; berry very large, usually "coxcombed," dark, firm, good, productive, tending to color unevenly. One of the best market berries.

Sunapee.—Medium; foliage heavy, glossy, dark; trusses moderately strong; berry medium, short-conic, good in color, soft, sour. Indifferent.

Vick.—Medium; foliage exceedingly dark, thick and glossy; trusses erect; berry medium to small, round or round-ovate, good in color, "seedy," fair in quality. Berries too small. We shall discontinue its cultivation.

Vineland.—High; foliage abundant; trusses very long and erect; berry medium to large, round, very light-colored, rather soft, poor, moderately productive, late. Comes in with the Kentucky which it closely resembles, only that it lacks the point of that berry. Of no prominence.

Wilson.—The Wilson has apparently "run out" with us. It sets many berries but they remain very small.

Woodruff No. 1.—Medium to low; foliage good, dark; trusses weak, the peduncles long; berry medium, conic with a very long point, dark, firm, fair in quality, the pips large and much sunken, not very prolific. Fruit has a hard core, and tends to become irregular in shape. Of no unusual merit.

Group 2.—Flowers pistillate.

Champion (*Windsor Chief*).—Medium; foliage good; trusses short, strong; berry medium, nearly spherical, very bright rich red, rather firm, sour, productive. The berries are not even in size and color. Color unusually good. An excellent market sort.

Crescent.—The most productive berry we grow, and therefore desirable for market. Otherwise it is a poor berry.

Daniel Boone.—Medium to high; foliage good; trusses rather weak; berry large, conic, often somewhat necked, very dark, rather soft, good, productive. A promising sort for near markets.

Green's Prolific.—Medium; foliage large, dark; trusses strong; berry medium, round, light-colored, soft, poor. Superseded by better sorts.

Hovey.—Medium to low; foliage dark; trusses weak; berry medium, conic, dark, rather soft, sweet and good. The first of the great American berries, interesting at the present day from its history. Our stock is from the originator, the late C. M. Hovey, Cambridge, Mass. Still a good berry.

Huddleston.—Medium to high; trusses not stout; berry medium, short-ovate, light in color, soft, fair to poor. Ripe June 10. Unpromising. Not sufficiently tested.

Jersey Queen.—Medium to low; foliage good; trusses weak; berry medium to large, very broad, light in color, rather firm, fair in quality. Of no prominence.

Jewell.—Low to medium; foliage pretty good, dark; trusses very low; berry medium, very short conic, poor in color, rather soft, moderately productive. Does not promise well. The fruit is borne very low. Stock from P. M. Augur.

Manchester.—Medium to low; trusses very low; berry medium to large, very short-conic with a blunt, flattened point, light but very even in color; firm; good. An excellent market berry, very uniform in size, shape and color. The berries are borne too near the ground. Productive, holding its crop late.

Miami.—Medium to large, vigorous; foliage good, dark; trusses moderately stout; berry medium to large, round, dark, rather firm; good; medium to late in season. Very promising. Not yet sufficiently tested.

Prince of Berries.—Low to medium; foliage pretty good, dark; trusses low, weak; berry small, round, soft, sweet. Of no value. Stock from Peter Henderson & Co.

V. LISTS OF FRUIT AND ORNAMENTAL PLANTS GROWING AT THE COLLEGE.—Many of the fruits here catalogued are not yet in bearing. Most of the apple trees are yet in nursery rows. Of many we have duplicates. It must be understood that fruits which we distribute but have not yet fruited are not guaranteed true to name. We receive scions and plants from many sources, and cannot always be sure of their identity, although we exercise every caution possible.

APPLES.

[Those marked with an asterisk (*) are Russian.]

Adams.
Aikin's Striped Winter.
Alabama Pippin.
American Summer Pearmain.
Annetta of Virginia.
*Anis.
*Antonovka.
*Aport.
*Aport Grosser.
*Arabka.
*Arabskoe.
Arnold's Beauty.
Autumn Swaar.
Autumn Sweet Bough.
*Babuschins.
Bailey's Sweet.
Baldwin.
Baltzley.
Barnes' Choice.
Bauman's Reinette.
*Belborodovkoe.
Belle de Boskoop.
Bellflower Pippin.
*Berkoff.
Best Red.
Ben Peffer.
Bennington Stripe.
Bernard.
Bidgood.
Baker.
Blackwood.
Bleason's Brag.
Blinkbonny.
Black Twig.
Blooming Orange.
*Borsdorf.
Bower's Nonpareil.
Boyd.
Brabant Bellflower.
Brown's Late Queen.
Brown's Sweet.
Brewington Pippin.
Brook's Pippin.
Buckingham.
Buncombe.
Cadwallader.
Callasaga.
Calville of St. Hilaire.
Camsack's Sweet.
Canada Baldwin.
Canada Late Strawberry.
Cardinal Celine.
Carpenter's Sweet.
Carter's Blue.
Carthouse.
Carolina Russet.
Cato.
Cellini.
Centennial.
Chadwick's Favorite.

*Charlamoff.
*Charlottenthaler.
Cheese of Pennsylvania.
Chebucto Beauty.
Chenango (Strawberry).
Choice.
*Christ Birth.
*Cinnamon Pine.
Clark's Orange.
Coat's Sweet.
Cole's Quince.
Columbian Russet.
Cook's Seedling.
Cooper's Early White.
Cooper's Market.
Cornell's Fancy.
Crackson.
Crawford's Keeper.
*Cross.
Curtis Greening.
*Czar's Thorn.
Daniel.
Dartmouth.
Dawes.
Dawes' Porter.
Decarie.
Delaware Winter.
Disharoon.
Dominie.
Doylestown.
Dr. Curd.
Dr. Watson.
Dr. Walker.
Durham's Winter.
Dyer.
Early Colton.
Early Harvest.
Early Pennock.
Early Red.
Early Ripe.
Early Strawberry.
*Early Sweet Voronesh.
Egg Top.
Elarkee.
*English Pippin.
*Enormous.
Evan's Seedling.
Ewalt.
Fallawater.
Fall Cheese of Virginia.
Fall Jennetting.
Fall Orange.
Fall Pippin.
Fall Queen of Kentucky.
Fall Spitzenburg.
Fameuse.
Fameuse Sucrée.
Fay's Early Joe.
Floy's Bellflower.
Fourth of July.
Franclin of Pennsylvania.
Fulton.
*Gaines' Swedisher.
Garden Royal.
Gardener's Bonne
General Grant.
*German Skrute.
Gibb's.
Gideon.
Gideon's No. 7.
Gideon's No. 9.
Gideon's No. 12.
Gideon's No. 13.
Gideon's No. 24.
Gideon's No. 28.
Golden Banana.
Golden Russet.
Golden Swartz.
Golden Sweet.
*Golden White.
*Good Peasant.
Gordon's Cluster.
Grange.
Gravenstein.
*Green Crimean.
Green Prolific of New Jersey.
*Green Streaked.
*Green Sweet.
*Gros Mogul.
Guilford.
Gully of Pennsylvania.
Haas.
Hancock.
Hampshire Sweet.
Harrison.
Hartford Sweet.

Haskel Sweet.
Hawley.
Hawthornden.
Hay's Wine.
Heath's Favorite.
Hemmingberger's Greening.
Henwood.
Herfordshire Pearmain.
Hesper Rose.
Hess.
Hewes' Virginia.
Hick's White.
Highland Beauty.
Hilpot.
Hockings.
Hooker.
Hoops.
Holdeman.
Holladay.
Horse.
*Howard's Best Russian.
Hubbardston.
Hubbardston Pippin.
Hudson's Streaked.
Hunterdon.
Huntsman.
Hutchison's Sweet.
Hyde's King.
Illinois Greening.
Imperial Russet.
Imperial Purple.
Indian.
Indiana Favorite.
Indiana Seedling.
Jackson.
Jacob's Favorite of Ohio.
January.
Jarmonite.
Jefferis.
Jersey Black.
Jersey Sweet.
John's Early White.
Johnson of Illinois.
*Juicy Krim Tartan.
Junaluskee.
Kansas Bellflower.
Kansas Queen.
Kent Island Pine.
Kentucky Streak.
Key's Red.
*Kievskoe.
Kinnard's Choice.
Kinney's Early.
Kinsy, or Nott County Seedling.
Kittageskee.
Klaproth.
*Kommenskoe.
Krouser.
Lady.
Lady Washington of Ohio.
Lane's Red Streak.
Lanier.
*Large Sub-acid.
Lankford.
Landon.
Lancaster Greening.
Large Green Pippin.
Large Red from Nova Scotia.
Late Strawberry.
Lawrence.
Leipprandt No. 1.
Leipprandt No. 2.
Leipprandt No. 3.
Lewis.
Likely.
Limbertwig.
Lincoln Pippin.
*Longfield.
Long Island Russet.
Long Red Pearmain.
Longworth Red Winter.
Lou.
Lyscom.
Maiden's Fair.
Maiden's Favorite.
Mann.
Marengo.
Maryland Red Streak.
Maryland Maiden Blush.
Marks.
Marquis.
Mary Warmack.
Mason.
Mason's Stranger.
Maverack's Sweet.
McLee's Mammoth.

McLellan.
McIntyre's Sweet.
McIntosh Red.
Melinda.
Matamusket.
Mettinger.
Mexico.
Minch.
Missouri Pippin.
Minkler.
Monarch.
Monmouth Pippin.
Moore's Extra.
Moore's Favorite.
Moore's Sweet.
Monte Bello.
Monstrous Bellflower.
Mosher Sweeting.
*Moscow Pear.
Mote's Sweet.
Mother.
Mother's Favorite.
Moultrie's Winter.
Mountaineer.
Muster.
Nansemond Beauty.
Nelson Rock.
Nero.
Ne Plus Ultra of Tenn.
Nicnac.
North Carolina Keeper.
Northern Spy.
O'Conner's Green.
Oconee Green.
October.
Oclesma.
Occident.
Ohio Plppin.
Oldenburgh.
Ontario.
Ortley.
Orange Pippin of N. J
*Ostrekoff Pippin.
Oxford.
Peach Bloom.
Peach Pond Sweet.
Peach Ridge.
Pear of Illinois.
Pennock.
Pewaukee.
Piedmont Pippin.
Peers.
Pickard's Reserve.
Pittsburg Pippin.
*Pointed Pipka.
Pomme Royal.
Pomeroy.
Porter.
Portsmouth Beauty.
Powers.
Presh's Winter.
Primate.
*Prolific Sweeting.
Pyle's Green Winter.
Quebec Red Winter.
Queen of the Kitchen.
Ragan's Yellow.
*Red Aport.
Red Astrachan.
Red Beitigheimer.
Red Canada.
Red Romanite.
Red Russet.
*Red Stettiner.
*Red Wine.
Red Winter.
*Reponka.
*Revel Pear.
Rhode Island Greening.
Ribston Pippin.
Richard's Graft.
Ridge Pippin.
Rock Pippin.
Rolfe.
Roman Stem.
Romanite.
Rome Beauty.
*Romna.
Rother Esk.
Royal Limbertwig.
*Royal Table.
Rubicon or Paw Paw.
Russel.
Rutman's Green.
Salome.
Santa.

Sawyer.
Scott's Winter.
Seedless.
Seek-No-Further.
September.
Shade's Winter.
Shannon.
Sharp's Winter.
Sheriff.
Sheepnose.
Shiawassee.
Shelling.
Shockley.
*Silken.
Sisk.
Skinner's Pippin.
Smith's Cider.
Smokehouse.
Southern King.
Sneep's.
Stayman's No. 1.
Stayman's No. 2.
Stayman's McAffee.
Stayman's Winesap.
Stevenson's Winter.
Stark.
Striped July.
Strode's Birmingham.
Stump.
St. Hilaire.
* St. Peters.
* Sugar Barbet.
* Summer Calville.
* Summer Lowland.
Summer Pippin.
Summer Sweet Paradise.
Summer Rambo.
Summer Red.
Summer Extra.
Summer Red Calville.
Summerset of N. J.
Superb Sweet.
Sutton Early.
Swaar.
Sweet Greening.
Sweet Limbertwig.
Sweet Romanite.
* Switzer.
Sylvester.
Talman Sweet.
Tenderskin.
Thin Skin.
* Titovka.
* Titus, of Voronesh.
Townsend.
Tewksbury Blush.
Turn of the Lane.
* Ukraine.
Vandevere Pippin.
* Vasile's Largest.
Vaughn's Winter.
Victoria Sweet.
* Voronesh.
Walbridge.
Washington Strawberry.
Wealthy.
Welford's Yellow.
Western.
White Pippin.
White Russian.
White Winter.
White Winter Pearmain.
Whinnery's Late Red.
Williams' Favorite.
Winesap.
* Winter Pear.
Wyle's Seedling.
Yadkin Beauty.
Yates.
* Yellow Arcadian.
Yellow Bellflower.
Yellow Butter.
Yellow Pippin.
* Yellow Transparent.
York Imperial.
York Stripe.
* Zolotoreff.
* Zweibel.
Various Seedlings.

Crabs.

Blushing Maid.
Chicago.
Conical.
Coral.
Currant.
Hasker Blush.
Hyslop.
Lady.
Large Yellow Siberian.
Paul's Imperial.
Maiden's Blush.
Meader's Winter.
Minnesota Winter.
Montreal Beauty.
Oblong.
Orange.
Orion.
Picta Striata.
Power's Large Red.
Quaker Beauty.
Telfer Sweet.
Transcendent.
Transparent.
Van Wyck.
Wanglis.
Whitney No. 20.

APRICOTS.

Breda.
Moorpark.
North China.
Russian.

BALCKBERRIES AND DEWBERRIES.

Blackberries.

Agawam.
Ancient Britton.
Bonanza.
Brunton's Early.
Crystal White.
Dehring's Early.
Dorchester.
Early Cluster.
Early Harvest.
Freed.
Kittatinny.
Knox.
Minnewaski.
Missouri Mammoth.
Parish's Pink.
Snyder.
Stayman's Early.
Stone's Hardy.
Taylor.
Wachuset.
Wallace.
Wilson's Early.
Wilson Junior.

Dewberries.

General Grant.
Lucretia.
Lucretia's Sister.

CHERRIES.

[Those marked with an asterisk are from Russia or adjacent regions.]

Belle de Choisy.
Belle Magnifique.
Black Eagle.
* Brusslar Braun.
Dyehouse.
Early Richmond.
Elton.
* Formigi Weichel.
Governor Wood.
* Grioff Precose.
* Lutovka.
May Duke.
Montmorency.
Morello.
* Ostheim.
Reine Hortense.
* Schattan Amarelle.
* Sklanka.
* Vilne Sweet.
Winsor.
Wragg.
Yellow Spanish.
Various Seedlings.

CURRANTS.

[The classification of currants is into Red, White, Black, Various Seedlings.

Red.

Cherry.
Fay.
Prince Albert.
Red Dutch.
Versaillaise.
Victoria.

White.

White Dutch.
White Gondoin.
White Grape.

Black.

Black Naples.

Various Seedlings.

GOOSEBERRIES.

Cluster.
Downing.
Houghton.
Industry.
Mountain.
Pale Red.
Smith.
Transparent.
Triomphe.

GRAPES.

Adirondac.
Advance.
Agawam.
American Muscadine.
Ariadne.
Bacchus.
Barry.
Berlin.
Black Eagle.
Black Hawk.
Brant.
Cambridge.
Canada.
Catawba.
Challenge.
Clinton.
Concord.
Conqueror.
Cornucopia.
Cottage.
Creveling.
Croton.
Cuyahoga.
Delaware.
Dracut Amber.
Early Dawn.
Elsinburg.
Elvira.
Essex.
Florence.
Gærtner.
Gœthe.
Golden Gem.
Hartford.
Haskell's Hybrids, Nos. 2, 35, 36, 58, 95, 184, 295, 300, 306, 340, 342, 343, 398.
Hayes.
Highland.
Irving.
Ives.
Janesville.
Jane Wylie.
Jessica.
Jewell.
Lindley.
Mammoth.
Martha.
Mary.
Mary Ann.
Massasoit.
Maxatawney.
Merrimac.
Montefiore.
Moore's Early.
Niagara.
Noah.
North Carolina.
Norton's Virginia.
Perkins.
Peter Wylie.
Progress.
Rebecca.
Rentz.
Requa.
Rogers' Nos. 5, 8, 30.
Taylor's Bullet.
To-Kalon.
Ulster.
Vergennes.
Waverly.
Wilder.
Wilmington Red.
(*Wyoming Red.*)
Woodruff.
Worden.

- *Vitis cordifolia × riparia.*
  - *Californica.*
  - *Berlandiera.*
  - *candicans.*
  - *cinerea.*
  - *candicans × rupestris.*
  - *rupestris.*
  - *monticola × rupestris.*
  - *coriacea.*
- *Vitis cordifolia.*
  - *Lincecumi.*
  - *monticola.*
  - *riparia.*
  - *Munsoniana.*
  - *cordifolia × Labrusca.*
  - *cordifolia × æstivalis.*
  - *æstivalis × cinerea.*

MULBERRIES.

Downing's Everbearing.
Russian.
Morus alba.
M. nigra.
M. Hispanica.

PEACHES AND NECTARINES.

Peaches.

Alexander.
Andrew's Mammoth.
Beer's Smock.
Blood-leaf.
Bray's Rareripe.
Chinese.
Chinese Cling.
Double Camellia-flowered.
Double White.
Early Canada.
Early Louise.
Ellison.
Franklin.
Gary's Hold On.
Golden Cuba.
Hill's Chili.
Jacques.
Jennie Worthen.
McCallister.
Morris Co. Rareripe.
Mountain White.
Mrs. Brett.
Old Mixon.
Peen-to.
Picquitt's Late.
Prince's Excelsior.
Pyramidal.
Salway.
Smock.
Tong-pa.
Van Buren's Dwarf.
Wager.
Washington.
Willow-leaf.
Yellow Extra.
Various seedlings.

Nectarines.

Boston.
Pitmaston Orange.

PEARS.

Anjou.
Bartlett.
Bessemianka.
Birket.
Bloodgood.
Bosc.
Boussock.
Brandywine.
Century.
Clapp.
Cocklin.
Daimyo.
Duchesse Hybrid.
Early Harvest of New Jersey.
Early Harvest of Ohio.
Garber.
Grand Isle.
Gray Doyenne.
Gris d'Hiver.
Hardy.
Howell.
Josephine de Malines.
Jefferson.
Kieffer.
Lawrence.
Little Gem.
Louise Bonne.
Lucrative.
Macomber.
Macomber's No. 6.

Madeleine.
Marshall.
Napoleon.
Onondaga.
Osband's Summer.
Refreshing.
Rostiezer.
Sandwich Island.
Seckel.
Sheldon.
Smith's Hybrid.
Sopiegianka.
Summer Doyenne.
Superfin.
Tyson.
Urbaniste.
Vicar.
White Doyenne.
Wild Bergamot.
Wilkinson's Winter.
Winter Nelis.

PLUMS.

Varieties of Prunus domestica.

[Those marked with an asterisk are from recent importations from Russia or adjacent regions.]

*Arab.
Bleecker's Gage.
Bradshaw.
German Prune.
* Hungarian.
Jefferson.
* Kazan.
Lombard.
* Merunka.
* Moldavka.
Moores' Arctic.
Niagara.
* Orel 19.
Pond.
Quackenbos.
Richland.
* Riga 11.
* Russian 2.
* Russian 3.
Shipper's Pride.
Shropshire Damson.
Smith's Orleans.
Tobias' Gage.
* Ungarish.
Washington.

Varieties of Prunus Americana and P. Chicasa.

Basset's American.
Clinton.
Cumberland.
DeCaradeuc.
Deep Creek.
De Soto.
Early Red.
Forest Garden.
Forest Rose.
Golden Beauty.
Hattie.
Indian Chief.
Indiana Red.
Itaska.
Jennie Lucas.
Kenyon.
Langdon.
Maquoketa.
Marianna.
Miner.
Minnesota.
Minnetonka.
Moreman.
Newman.
Parsons.
Purple Yosemite.
Quaker.
Rollingstone.
Wayland.
Wazata.
Weaver.
Wild Goose.
Wolf.
Yellow Yosemite.
Various seedlings.

RASPBERRIES.

Red.

Amazon.
Crimson Beauty.
Cuthbert.
Diadem.
Early Prolific.
Fastolf.
Franconia.
Hansell.
Heebner.
Henrietta.
Herstine.
Highland Hardy.
Little.
Little's Prolific.
Lost Rubies.
Marlboro.
Michigan Early.
Miller's Favorite.
Montclair.
Nameless.
Niagara.
Parnell.
Philadelphia.
Prosser.
Queen.
Rancocas.
Red Cluster.
Reder.
Reliance.
Superb.
Surprise.
Talcott.
Thwack.
Turner.
Welsh.
Numerous seedlings.

Yellow; mostly Rubus Idæus.

Beebe's Golden.
Belle de Fontenay.
Brincklé's Orange.
Caroline.
Golden Queen.
Ker's White.
Macomber.
River's Yellow.
Yellow Antwerp.

Black.

Ada.
Centennial.
Davison (Thornless).
Doolittle.
Earhart.
Gregg.
Hilborn.
Hopkins.
Johnson's Sweet.
Kellogg.
Macomber No. 2.
Mammoth Cluster.
Ohio.
Pride of the West.
Shaffer.
Springfield.
Sweet Home.
Tyler.
Wetherbee.

STRAWBERRIES.

Flowers perfect or bisexual.

[The dagger placed before a variety indicates that the stamens are many and well developed, and that the variety will likely prove valuable as a fertilizer.]

Agriculturist. Stamens very few.
Alley's No. 9.
Alpha.
†Arlington.
Arnold's Pride.
†Atlantic.
†Belmont.
†Bidwell.
†Big Bob.
Black Defiance.
Bright Ida.
†Capt. Jack.
Cheney. Stamens very few.
†Cinderella.
Columbus Wilson. Stamens very few.
Countess.
†Cowing.
†Crystal City.
†Cumberland.
†Damask Beauty.
Downing.
†Duchess.
†Duncan.
Ellisdale.
†Emeral
Emma.
Erebus.
Eureka. Stamens very few.
Excelsior.
†Finch (Finch's Prolific).
Garretson. Stamens very poor.
†Glendale.
†Goldsmith.
†Great American.
†Hart's Minnesota.
Hathaway's No. 3. Stamens very few.
Heffner's No. 1.
Henderson. Stamens very few.
Hervey Davis.
Howell.
†Ideal.
Indiana.
Jessie.
Jucunda.
Kentucky.
Kinney's Eclipse.
Lacon. Stamens very few.
†Longfellow Improved.
Louella.
†Lower.
Maggie.
Magnum Bonum.
Marvin.
†Mary Fletcher.
†May King.
†Minamed.
Miner.
†Minnetonka.
†Moore's Early.
†Mrs. Garfield
†Mt. Vernon.
New Dominion.
New Jersey Scarlet.
†Nicanor.
Nigh's Superb.
†Noble's Seedling.
Norman.
†Old Iron Clad.
†Ontario.
†Orient.
†Parry.
Pautucket.
Philadelphia.
†Photo.
Pioneer (King of the North).
Piper.
†President Lincoln.
Prouty.
Reed's Late Pine.
Richmond.
Russell's Advance.
Seneca Queen.
†Sharpless.
Shirts.
†Sucker State.
Sunapee.
Triomphe de Gand.
†Vick.
Vineland.
†Warren.
†Wilson.
Woodruff No. 1.

Flowers strictly pistillate.

Bancroft.
Belle.
Champion (Windsor Chief).
Connecticut Queen.
Cornelia.
Crawford's No. 93.
Crescent.
Daniel Boone.
Fairy.
Gipsy.
Grand Duke.
Green Prolific.
Hathaway's No. 5.
Hathaway's No. 9.
Heffner's No. 2.
Hovey.
Huddleston.
Jersey Queen.
Jewell.
Jockey Cap.
Manchester.
Miami.
Neuman.
Prince of Berries.
Twin.
Woodruff No. 2.

The following have not yet fruited with us.

Bubach.
Cardinal.
Cohanzick.
Crawford.
Crimson Cluster.
Daisy.
Gandy's Prize.
Gold.
Gothic.
Haverland.
Itaska.
Kirkwood.
Lida.
Livingston.
Mammoth.
Marion.
Monmouth.
New Continental.
Ohio.
Prairie Queen.
Queen of the West.
Summit.
Tritt's Surprise.
Victoria.
Many Seedlings.

The following Foreign Species are Grown.

Alpine Wood.
Belle Bordelaise.
Royal Hautbois.

MISCELLANEOUS LIST OF FRUITS.

Simon's Plum, *Prunus Simoni.*
Wild Peach, *P. umbellata.*
Beach Plum, *P. maritima.*
Dwarf or Sand Cherry, *P. pumila.*
David's Peach, *P. Davidiana.*
Mahaleb, *P. Mahaleb.*
Myrobolan Plum, *P. Myrobolanus.*
Wild Olive, *Elæagnus angustifolia.*
Russian Olive, *E. Songorica.*
Walnut, *Juglans nigra.*
Elder, *Sambucus racemosa.*
Huckleberries, *Vaccinium corymbosum, V. vacillans, V. Pennsylvanicum, V. Canadense.*

Wild Crab, *Pyrus coronaria.*
    P. Toringa.
    P. Malus var. *spectabilis.*
    P. Malus var. *orthocarpa.*
    P. prunifolia var. *flava.*
Medlar, *Pyrus Germanica.*
    P. salicifolia.
    P. betulifolia.
    P. Sinensis.
June-berry, *Amelanchier Canadensis.*
Dwarf June-berry or Service, *A. canadensis* var.
Paradise Stocks.
Quinces,—Orange and Meech.
Barberry, *Berberis vulgaris.*
    B. trifoliata.
Wild Black Currant, *Ribes floridum.*
    Ribes prostratum.
Prickly Pear, *Opuntia Rafinesquii.*
Bear Bramble, *Rubus ursinus.*
Mazzard Cherry.
Blackman Plum (supposed hybrid of peach and plum).
Chinquapin, *Castanea pumila.*
Japanese Chestnut.
Spanish Chestnut.

ORNAMENTAL TREES AND SHRUBS.

Aside from the following plants, many curious and ornamental trees and shrubs are growing in the College arboretum.

Alders: Wild, *Alnus serrulata.*
    Cut-leaf, *A. glutinosa* hort. *laciniata.*
Almond: Flowering, *Prunus nana.*
Arbor-vitæ: Common, *Thuja occidentalis.*
    Sibirian, *T. occidentalis* hort. *Sibirica.*
    Hovey's, *T. occidentalis* hort. *Hoveyi.*
    Pyramidal, *T. occidentalis* hort. *pyramidalis.*
    Heath-like, *T. occidentalis* hort. *ericoides.*
    Globose, *T. occidentalis* hort. *globosa.*
Ashes: White, *Fraxinus Americana.*
    Black, *F. sambucifolia.*
    Red, *F. pubescens.*
Bald Cypress: *Taxodium distichum.*
Barberries: Common, *Berberis vulgaris.*
    Mahonia, *B. Aquifolium.*
Basswoods: Common, *Tilia Americana.*
    Broad-leafed, *T. platyphylla.*
    Weeping white, *T. alba* hort. *pendula.*
    European, *T. Europæa.*
Beech: *Fagus ferruginea.*
Birch: White, *Betula alba.*
    Cut-leaf weeping white, *B. alba* hort. *laciniata.*
    Canoe, *B. papyrifera.*

Bittersweet: *Celastrus scandens.*
Bladder-nut: *Staphylea trifolia.*
Blue-beech: *Carpinus Americana.*
Box-elder: *Negundo aceroides.*
Brambles: Blackberry, *Rubus villosus.*
    Black raspberry, *R. occidentalis.*
Buckeyes and Horse-chestnuts:
    Horse-chestnut, *Æsculus Hippocastanum.*
    Ohio, *Æ. glabra.*
    Dwarf, *Æ. parviflora.*
Buckthorn: *Rhamnus catharticus.*
Burning-bush: *Euonymus atropurpureus.*
Catalpas: Small-flowered, *Catalpa bignonioides.*
    Large-flowered, *C. speciosa.*
    Kaempfer's, *C. Kaempferi.*
    Teas' Hybrid.
Cedar: *Juniperus Virginiana.*
Cherries: Wild black, *Prunus serotina.*
    Choke, *P. Virginiana.*
    Bird, *P. Padus.*
    Sand, *P. pumila.*
    Double-flowered sweet.
    Double-flowered sour.
Chestnut: *Castanea vesca.*
Clematis: Common wild, *Clematis Virginiana.*
    Various garden varieties.
Coffee-tree: *Gynnocladus Canadensis.*
Cucumber-tree: *Magnolia acuminata.*
Currant: Buffalo, *Ribes aureum.*
Deutzia: *Deutzia crenata.*
Dogwoods, Osiers.
    Flowering, *Cornus florida.*
    Alternate-leaved, *C. alternifolia.*
    Paniculate, *C. paniculata.*
    Red osier, *C. stolonifera.*
    Siberian, *C. Sibirica.*
Dutchman's Pipe: *Aristolochia Sipho.*
Elders: Common, *Sambucus racemosa.*
    Black, *S. nigra* hort. *variegata.*
Elms: Common, *Ulmus Americana.*
    Red, *U. fulva.*
    Cork, *U. racemosa.*
    English, *U. campestris.*
    Wheatley's English.
Fringe-tree: *Chionanthus Virginica.*
Grape: Wild, *Vitis riparia.*
Ginkgo: *Ginkgo bifolia.*
Hazels: Common, *Corylus Americana.*
    Beaked, *C. rostrata.*
Hercules' Club: *Aralia spinosa.*
Hickories: Shellbark, *Carya alba.*
    Bitternut, *C. amara.*

Honeysuckles: *Lonicera Tartarica.*
L. fragrantissima.
Hop-tree: *Ptelea trifoliata.*
Hydrangea: *Hydrangea paniculata* hort. *grandiflora.*
H. radiata.
Iron-wood: *Ostrya Virginica.*
Itea: *Itea Virginica.*
June-berry: *Amelanchier Canadensis.*
Junipers: Common, *Juniperus communis.*
Swedish, *J. communis* hort. *Suecica.*
Irish, *J. communis* hort. *Hibernica.*
Northern, *J. Sabina* var. *procumbens.*
Larches: American or Tamarack, *Larix Americana.*
European, *L. Europæa.*
Lead-plant: *Amorpha fruticosa.*
Lilac: Common, *Syringa vulgaris,* lilac and white.
Josikea, *S. Josikæa.*
Persian, *S. Persica.*
Locusts: Honey, *Gleditschia triacanthos.*
Common, *Robinia Pseudacacia.*
Rose acacia, *R. hispida.*
Maples: Sugar, *Acer saccharinum.*
Black, *A. nigrum.*
Red, *A. rubrum.*
Silver, *A. dasycarpum.*
Sycamore, *A. Pseudo-Platanus.*
Norway, *A. platanoides.*
Mountain, *A. spicatum.*
European, *A. campestre.*
Tartarian, *A. Tartaricum.*
Wier's, *A. dasycarpum* hort. var.
Mock Orange: *Philadelphus coronarius.*
Moosewood: *Dirca palustris.*
Mulberries: Wild, *Morus rubra.*
Black, *M. nigra.*
White, *M. alba.*
Spanish, *M. Hispanica.*
Russian.
Nettle-tree: *Celtis occidentalis.*
Oaks: White, *Quercus alba.*
Swamp white, *Q. bicolor.*
Burr, *Q. macrocarpa.*
Black, *Q coccinea* var. *tinctoria.*
Black-jack, *Q. nigra.*
Chestnut, *Q. Prinus* var. *acuminata.*
Red, *Q. rubra.*
Osage Orange: *Maclura aurantiaca.*
Pea-tree: *Caragana arborescens.*
Peaches: Double white.
Double camellia.
Golden Cuba.

Peaches: Willow-leaf.
Blood-leaf.
Pyramidal.

Pines: White, *Pinus Strobus.*
Austrian, *P. Austriaca.*
Scotch, *P. sylvestris.*
Corsican, *P. Corsica.*
Cembrian, *P. Cembra.*
Scrub, *P. Banksiana.*
Red, *P. resinosa.*
Dwarf, *P. pumilio.*

Plane-tree: *Platanus occidentalis.*

Plums: Wild, *Prunus Americana.*
Pissard's, *P. Pissardi.*

Poplars: Large-toothed, *Populus grandidentata.*
Weeping, *P. grandidentata* hort. *pendula.*
Aspen, *P. tremuloides.*
White, *P. alba.*
Lombardy, *P. dilatata.*
Cottonwood, *P. monilifera.*

Prickly Ash: *Zanthoxylum Americanum.*

Pyruses: Apple, *Pyrus Malus.*
Double-flowering apple, *P. Malus* hort. var.
Mountain Ash, *P. Aucuparia.*
Hall's, *P. Halleana.*
Wild, *P. coronaria.*
Flowering crab, *P. floribunda.*
Choke-berry, *P. arbutifolia.*
P. domestica.
P. hybrida.

Quince: Japanese, *Pyrus Japonica.*
Retinosporas.
Rhododendron: *Rhododendron Catawbiense.*
Rhodotypus: *Rhodotypus kerrioides.*
Roses: Swamp, *Rosa Carolina.*
Dwarf, *R. humilis.*
Pea-fruited, *R. pisocarpa.*
Sassafras: *Sassafras officinalis.*
Silver-Ball: *Halesia tetraptera.*
Smilax: *Smilax hispida.*
Spireas: *Spiræa sorbifolia.*
S. triloba.

Spruces: White, *Picea alba.*
Black, *P. nigra.*
Norway, *P. excelsa.*
Dwarf Norway, *P. excelsa* hort. var.
Oriental, *P. orientalis.*
Blue fir, *P. pungens.*
Balsam fir, *P. balsamea.*
Hemlock, *Tsuga Canadensis.*

Sumacs: Smoke-tree, *Rhus Cotinus.*
  Common, *R. typhina.*
  Dwarf, *R. copallina.*
Tamarisk: *Tamarix Gallica.*
Thorns: English, *Cratægus Oxyacantha.*
  Cock-spur, *C. Crus-galli.*
  Red, *C. coccinea.*
  Punctate, *C. punctata.*
  Douglas', *C. Douglasii.*
Viburnums: Snow-ball, *Viburnum Opulus.*
  Arrow-wood, *V. dentatam* and *V. pubescens.*
  Dockmackie, *V. acerifolium.*
  Sheep-berry, *V. Lentago.*
Virginia Creeper and Japanese Ivy: *Ampelopsis quinquefolia.*
  Ivy, *A. tricuspidata.*
Walnut: *Juglans nigra.*
White-wood: Tulip-tree, *Liriodendron Tulipifera.*
Willows: Wisconsin weeping, *Salix Babylonica?*
  Black, *S. nigra.*
  White, *S. alba.*
  Shining, *S. lucida.*
  Petioled, *S. petiolaris.*
  Pussey, *S. discolor.*
  Beaked, *S. rostrata*
Winter-bery: *Ilex verticillata.*
Wistaria: *Wistaria Sinensis.*
Witch Hazel: *Hamamelis Virginica.*
Yellow-wood: *Cladrastis tinctoria.*

VI. CALENDAR OF TREES AND SHRUBS.—A knowledge of the times of the appearing and fall of the leaves of plants is important in many respects, especially when the observation extends over a period of years. It is necessary to a correct knowledge of the vital processes in plants. It is also invaluable in determining the varying periods of growth in different latitudes and under varying conditions. It also enables us to form an accurate judgment of the comparative progress of the seasons in different years. For two and a half years we have kept an accurate record of the appearing and the fall of leaves in various trees and shrubs upon the College grounds. These records are now presented in a tabulated form.

In almost every case a single average tree or shrub has been selected for observation during the three years. While this method gives us the characteristics of the individual rather than of the species, it is, nevertheless, invaluable from the fact that it eliminates all variations due to soil and exposure; and the writer is confident, from a considerable observation, that even these selected and isolated specimens represent very closely the characteristics of the species.

It is of course impossible to fix an exact date upon which the leaves of any plant begin to fall. An occasional leaf may fall at any time. In the following table the date of the first falling of the leaves designates the day when the first conspicuous fall, due to the maturity of the leaf, took place. In the instance of the oaks, which usually hold a portion of their leaves during the winter, no date has been fixed to designate the entire bareness of the branches. Usually the last leaves to disappear from most trees are those on the higher or younger shoots. These shoots mature last. "With respect to the fall of leaves, it has been noticed that three more or less distinct periods are observable. The first occurring, on an average, a week earlier than the main fall, is marked by the loss of the leaves of the weakly twigs. The second comprises the main defoliation. The third embraces the period during which straggling leaves, mostly on branches which have been shaded during the growing season, successively disappear. This period is often limited only by the beginning of growth the next spring."*

The following tables can afford a basis for the comparative study of plant life only as they are compared with similar observations made in other places. The critical reader will be liable to learn from them alone, among other things, something of the earliness or lateness of the last three seasons, however.

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* Wm. Trelease, 2 nd. Rep. Wis. Exper. Sta., 59.

CALENDAR OF TREES AND SHRUBS—AUTUMN OF 1885, SEASONS OF 1886 AND 1887.

Species.	Leaves began falling.			Leaves all fallen.			Leaves starting.		Leaves full-grown.		Remarks.
	1885.	1886.	1887.	1885.	1886.	1887.	1886.	1887.	1886.	1887.	
Nettle-tree, *Celtis occidentalis*	Oct. 2	....	Oct. 10	Oct. 27	Oct. 13	Oct. 24	May 5	May 12	....	June 6	
English Thorn, *Cratægus Oxyacantha*, var	Sept. 25	Oct. 30	Oct. 10	....	....	....	Apr. 26	May 3	June 1	June 6	In blossom May 18.
Hickory, *Carya alba*	Sept. 26	Oct. 13	....	Oct. 10	Oct. 25	Oct. 3	May 3	May 12	May 27	June 6	In blossom May 16.
Hop-tree, *Ptelea trifoliata*	Sept. 26	Oct. 8	....	....	Oct. 18	....	....	May 18	....	June 1	In blossom June 13.
Poison-ivy, *Rhus Toxicodendron*	Sept. 28	Oct. 6	....	Oct. 20	Oct. 18	Oct. 3	May 6	May 15	June 1	....	In blossom June 13.
June-berry, *Amelanchier Canadensis*	Sept. 29	Oct. 8	Oct. 3	Oct. 20	Oct. 25	Oct. 10	Apr. 25	....	May 24	....	
Lilac, *Syringa vulgaris*	Nov. 3	Oct. 30	Oct. 18	Nov. 7	....	....	Apr. 19	May 12	May 12	June 6	In blossom May 3.
Norway Maple, *Acer platanoides*	Oct. 22	Oct. 13	Oct. 10	Nov. 1	Oct. 31	Oct. 21	Apr. 24	May 9	May 24	May 30	In blossom May 3.
Red Maple, *A. rubrum*	....	Oct. 8	Oct. 9	Oct. 10	Oct. 31	Oct. 28	Apr. 24	May 14	May 25	....	In blossom April 19; fruit falling May 26.
Silver Maple, *A. dasycarpum.*	Sept. 27	Oct. 13	Oct. 10	Oct. 17	Oct. 30	Oct. 28	....	May 3	....	June 6	In blossom April 19.
Sycamore Maple, *A. Pseudo-platanus*	Oct. 26	Oct. 25	Oct. 10	Nov. 1	....	....	May 3	May 12	May 28	June 1	
Wild Mulberry, *Morus rubra*	Sept. 29	Oct. 25	....	Oct. 15	....	....	Apr. 26	May 16	May 26	June 1	
Black Oak, *Quercus coccinea*, var. *tinctoria*	Oct. 20	Oct. 12	Oct. 10	....	....	....	May 3	May 12	May 27	June 6	In blossom May 9.
Burr Oak, *Q. macrocarpa*	Oct. 3	Oct. 12	Oct. 9	....	....	....	May 3	May 14	June 1	....	In blossom May 18.
Chestnut Oak, *Q. Prinus*	Oct. 15	Oct. 18	Oct. 10	....	....	....	May 5	May 12	June 1	....	
Red Oak, *Q. rubra*	Oct. 25	Oct. 12	....	....	....	....	May 4	May 9	June 1	June 6	
White Oak, *Q. alba*	Oct. 1	Oct. 12	Oct. 10	....	....	....	May 4-10	May 16	June 4	June 6	In blossom May 20.
Pea-tree, *Caragana arborescens*	Oct. 6	Oct. 25	....	Nov. 3	....	....	Apr. 24	....	May 24	....	
Pepperidge, *Nyssa multiflora*	Sept. 29	Oct. 12	....	Oct. 15	Oct. 25	....	May 5	....	June 1	....	
Lombardy Poplar, *Populus dilitata*	Oct. 16	Oct. 25	Oct. 11	Nov. 2	....	....	Apr. 26	May 9	May 24	....	
White Poplar, *P. alba*	Sept. 28	Oct. 12	Oct. 11	Oct. 22	Oct. 30	....	Apr. 25	....	May 28	....	
Sassafras, *Sassafras officinale*	Sept. 29	Oct. 10	....	Oct. 15	Oct. 18	....	May 12	May 26	....	....	

CALENDAR OF TREES, SHRUBS, ETC.,—CONCLUDED.

Species.	Leaves began falling.			Leaves all fallen.			Leaves starting.		Leaves full-grown.		Remarks.
	1885.	1886.	1887.	1885.	1886.	1887.	1886.	1887.	1886.	1887.	
Smoke-tree, *Rhus cotinus*	Oct. 20	Oct. 18		Nov. 8			May 5	May 9	May 28	June 6	In blossom June 1; fruit falling July 11.
Snowball, *Viburnum Opulus*	Oct. 24	Oct. 18		Nov. 5			Apr. 22	May 3	May 26		In blossom May 14 to June 6.
Poison Sumac, *Rhus venenata*	Sept. 28	Oct. 12	Oct. 3	Oct. 5	Oct. 18	Oct. 10	May 6	May 16	June 1	June 6	In blossom June 13.
Tulip-tree, *Liriodendron Tulipifera*		Oct. 12	Oct. 7	Oct. 12	Oct. 25	Oct. 17	Apr. 26	May 9	May 28	June 13	In blossom June 1 to 13.
Virginia Creeper, *Ampelopsis 5-folia*	Sept. 28	Oct. 18	Oct. 3	Oct. 10	Oct. 25	Oct. 17	May 3	May 9	May 27		In blossom July 5.
Walnut, *Juglans nigra*	Sept. 24			Oct. 12	Oct. 13		May 4	May 14	June 7		
White Willow, *Salix alba*	Sept. 28	Oct. 13	Oct. 9				Apr. 21	Apr. 27	May 27	June 6	Fruit falling June 6.
Black Willow, *S. nigra*	Sept. 30	Oct. 6		Oct. 30	Oct. 25		Apr. 25	May 3	May 28		
Yellow-wood, *Cladrastis tinctoria*	Oct. 1	Oct. 12	Oct. 1	Oct. 20	Oct. 25	Oct. 7	Apr. 26	May 9	May 23	June 13	
Catalpa, *Catalpa speciosa*	Sept. 28	Oct. 8		Oct. 22	Oct. 30		May 3		June 7		
Sugar Maple, *Acer saccharinum*			Oct. 6			Oct. 17		May 9		June 1	In blossom April 27.
Black Sugar Maple, *A. nigrum*			Oct. 2			Oct. 12		May 9			In blossom May 3.
Mock Orange, *Philadelphus coronarius*		Oct. 13	Oct. 10		Oct. 18		Apr. 25	Apr. 27	May 27		In blossom June 1 to 13.
Weeping Willow, *Salix Babylonica*							Apr. 21	Apr. 27	May 27	June 1	
Alder, *Alnus serrulata*	Oct. 3	Oct. 18	Oct. 17	Nov. 10			Apr. 20	May 3	May 10		In blossom April 16; fruit falling June 13.
Alder, *A. glutinosa*	Oct. 15	Oct. 17	Oct. 7	Nov. 15			Apr. 24	May 3	May 25	June 10	In blossom April 16.
Black Ash, *Fraxinus sambucifolia*	Sept. 25	Oct. 6		Oct. 8	Oct. 12	Oct. 2	May 2		May 28		
Green Ash, *F. viridis*	Sept. 30	Oct. 8		Oct. 19	Oct. 25		Apr. 26	May 12	May 26		
Mountain Ash, *Pyrus Aucuparia*	Oct. 2	Oct. 10	Oct. 11	Nov. 1			Apr. 21	May 3	May 10	June 1	In blossom June 1; fruit bright orange August 3.
Prickly Ash, *Zanthoxylum Americanum*		Oct. 18			Oct. 30						
Red Ash, *Fraxinus pubescens*	Sept. 20			Sept. 26			Apr. 26	May 14	May 27	June 6	
White Ash, *F. Americana*	Sept. 27	Oct. 8		Oct. 5	Oct. 25		Apr. 28		May 28		

Aspen, *Populus tremuloides*	Oct. 16	Oct. 12	Oct. 17	Nov. 5	....	....	Apr. 23	May 9	May 10	June 6	In blossom April 19.
Large-toothed Aspen, *P. grandidentata*	Oct. 6	....	Oct. 10	Oct. 20	....	Oct. 30	Apr. 29	May 9	May 27	June 6	
Weeping Aspen, *P. grandidentata*, hort. *pendula*.	Oct. 22	Oct. 18	Oct. 15	Nov. 9	Oct. 30	....	May 1	May 9	May 21	June 6	In blossom April 16.
Balsam Poplar, *P. balsamifera*	Oct. 6	Oct. 13	....	Oct. 28	Oct. 30	....	Apr. 27	May 12	June 1	June 6	
Barberry, *Berberis vulgaris*	Oct. 20	....	Oct. 11	....	....	....	Apr. 24	Apr. 27	May 24	....	In blossom May 26.
Basswood, *Tilia Americana*	Sept. 25	Oct. 8	Oct. 4	Oct. 17	Oct. 13	Oct. 17	May 3	May 12	May 26	June 13	
Beech, *Fagus ferruginea*	Sept. 29	Oct. 12	Oct. 3	Oct. 28 to Nov. 10.	Oct. 30	....	May 5	May 12	May 28	June 6	
Blue Beech, *Carpinus Americana*	Sept. 26	Oct. 12	Oct. 1	Oct. 16	Oct. 18	Oct. 5	Apr. 27	May 9	May 29	June 6	In blossom May 9.
Cut-leaved Weeping Birch, *Betula alba*, var.	Sept. 21	Oct. 12	Oct. 7	Oct. 25	....	Oct. 28	Apr. 22	May 3	May 24	June 6	
Bitternut, *Carya amara*	Sept. 25	Oct. 13	Oct. 5	Oct. 30	Oct. 25	Oct. 12	Apr. 29	May 9	June 1	June 6	In blossom May 14.
Bladdernut, *Staphylea trifolia*	Sept. 27	Oct. 18	Oct. 5	Oct. 26	Oct. 30	Oct. 17	Apr. 25	May 3	May 25	June 13	In blossom May 12.
Box Elder, *Negundo aceroides*	Sept. 30	Oct. 8	Oct. 2	Oct. 17	Oct. 18	Oct. 7	Apr. 22	May 14	May 23	June 6	In blossom April 27.
Buckthorn, *Rhamnus catharticus*	Sept. 30	Oct. 18	....	Oct. 18	....	....	Apr. 26	....	May 26	....	
Butternut, *Juglans cinerea*	Sept. 28	Oct. 8	....	Oct. 12	Oct. 18	....	May 3	May 12	June 1	....	
Buttonwood, *Platanus occidentalis*	Oct. 1	Oct. 18	Oct. 9	Oct. 28	....	Oct. 28	May 3	May 12	June 6	June 13	
Black Cherry, *Prunus serotina*	Sept. 25	Oct. 8	Oct. 6	Oct. 22	Oct. 18	Oct. 17	Apr. 21	Apr. 27	May 25	May 30	
Choke Cherry, *P. Virginiana*	....	Oct. 12	Oct. 1	Oct. 26	Oct. 25	Oct. 28	Apr. 20	May 3	May 1	June 6	In blossom May 12.
Chestnut, *Castanea vesca*	Sept. 28	Oct. 12	Oct. 4	Oct. 23	Oct. 30	Oct. 26	May 3	May 12	May 27	June 1	In blossom June 18 to July 12.
Chinquapin, *C. pumila*	Oct. 10	Oct. 13	....	Oct. 28	Oct. 30	....	May 2	May 12	May 27	June 6	In blossom June 19 to July 5.
Horse-chestnut, *Æsculus Hippocastanum*	Sept. 30	Oct. 8	Oct. 10	Oct. 25	....	....	Apr. 21	May 9	June 1	June 10	In blossom May 16.
Coffee-tree, *Gymnocladus Canadensis*	....	....	....	Sept. 26	Oct. 12	Oct. 4	....	May 18	....	....	
Cottonwood, *Populus monilifera*	Sept. 26	Oct. 8	Oct. 5	Oct. 19	Oct. 25	Oct. 17	May 5	May 12	May 28	June 13	
Wild Crab, *Pyrus coronaria*	Oct. 23	Oct. 12	....	Oct. 27	Oct. 30	....	Apr. 28	May 14	May 25	....	
Elm, *Ulmus Americana*	Sept. 27	Oct. 8	Oct. 10	Oct. 20	Oct. 25	Few off Oct. 28.	Apr. 26	May 9	May 26	....	In blossom April 27.
Red Elm, *U. fulva*	Sept. 28	Oct. 8	Oct. 5	Oct. 5	Oct. 18	Oct. 24	May 1	May 9	May 28	June 6	
Cork Elm, *U. racemosa*	Sept. 25	....	....	Oct. 26	Oct. 18	....	Apr. 26	May 9	May 28	....	
English Elm, *U. campestris*	Oct. 1	Oct. 12	....	Nov. 1	....	....	Apr. 26	....	May 27	....	

ADDITIONAL LIST.—1887.

Species.	Leaves starting.	Leaves full grown.	Leaves beginning to fall.	Leaves all fallen.	Remarks.
Smooth Buckeye, *Æsculus glabra*	May 3	June 14	....	Oct. 5	In blossom May 12.
Small-flowered Buckeye, *Æ. parviflora*	May 9	June 6	Oct. 3	Oct. 21	In blossom July 5 to 19.
Lead-plant, *Amorpha fruticosa*	May 12	....	Oct. 3	Oct. 7	In blossom June 6.
Canoe Birch, *Betula papyrifera*	May 9	June 6	Oct. 18	Oct. 27	
Flowering Dogwood, *Cornus florida*	May 12	June 6	Oct. 5	Oct. 21	In blossom May 18.
Siberian Dogwood, *C. Sibirica*	May 3	June 1	Oct. 3	Oct. 24	In blossom May 16.
Beaked Hazel, *Corylus rostrata*	May 9	June 6	....	Oct. 5	
Thorn, *Cratægus Crus-galli*	May 9	June 6	Oct. 4	Oct. 28	In blossom May 26.
Burning bush, *Euonymus atropurpureus*	Apr. 19	....	Oct. 5	Oct. 21	In blossom June 13 to 29.
Ginkgo, *Ginkgo biloba*	May 16	....	Oct. 6	Oct. 17	
Honey Locust, *Gleditschia triacanthus*	May 12	June 6	....	Oct. 5	
Cucumber-tree, *Magnolia acuminata*	May 14	June 6	Oct. 7	Oct. 21	In blossom May 26.
Ninebark, *Physocarpus opulifolia*	May 9	....	Oct. 1	Oct. 21	In blossom June 10.
Flowering almond, *Prunus nana*	May 3	June 1	Oct. 3	....	In blossom May 9.
Black oak, *Quercus nigra*	May 12	June 6	Oct. 11	Oct. 21	
Buffalo Currant, *Ribes aureum*	Apr. 16	....	Oct. 7	....	In blossom May 9.
Wild Currant, *R. Cynosbati*	May 18	....	....	Oct. 5	
Wild Black Currant, *R. floridum*	Apr. 16	....	Oct. 2	....	In blossom May 8.
Rose Acacia, *Robinia hispida*	May 12	....	Oct. 3	Oct. 27	In blossom May 26 to June 25.
Locust, *R. Pseudacacia*	May 9	June 6	Oct. 9	Oct. 24	In blossom May 26.
Elder, *Sambucus Canadensis*	May 9	June 6	Last of Sept.	Oct. 28	In blossom June 19.
Josikea Lilac, *Syringa Josikæa*	May 3	June 1	Oct. 5	Oct. 28	In blossom May 25.
Persian Lilac, *S. Persica*	Apr. 19	....	Oct. 10	....	In blossom May 12.
White Basswood, *Tilia alba* var. *pendula*	May 9	June 1	Oct. 4	Oct. 17	In blossom July 11.
Broad-leafed Basswood, *T. platyphylla*	May 12	June 13	Oct. 3	Oct. 17	
Wild Grape, *Vitis riparia*	May 12	....	....	Oct. 3	In blossom May 20,
Hercules' Club, *Aralia spinosa*	May 3	June 6	....	Oct. 4	In blossom July 11 to Aug. 3.

Few are aware that the season of growth in most woody plants extends scarcely to midsummer. It is worthy of note that most, if not all, native trees and shrubs cease growing very early in the season. This is no doubt one reason why they are able to endure the winter. Plants which cease to grow early and which mature their wood well are often said to be *determinate* in their growth, while those of opposite habit are said to be *indeterminate.* It is of course apparent that plants of indeterminate growth are not hardy, as a rule.

A series of careful measurements of growth were made upon various trees and shrubs this year, and the records are presented below. The last date in each case designates the termination of growth for the year. It will be observed that very few of the plants grew until July. This fact is illustration and proof that in our rigorous climate cultivation should stop early, and that it should be vigorous at the opening of the season. There are many questions concerning the physiology and vital processes of plants which demand such facts as those presented in the following table, when they have been recorded for a period of years and in a number of places. Last year a very extensive series of similar notes and measurements was made upon very many varieties of the vegetable and fruit garden. It is expected that these shall be continued and in time collated. It is probable that facts of great practical importance are to be discovered by this means.

In making the measurements recorded below, one average shoot was selected on each plant and measured from time to time during the growing season. The drouth may have checked growth to some degree, although it did not become severe until the end of June. Most of the plants stand upon the campus, with no cultivation. A few are younger and stand in the rows of a closely planted arboretum where they receive occasional culture, or in a newly-planted group where the soil is frequently hoed; these plants are designated by asterisks.

RECORDS OF GROWTH.

Acer dasycarpum—May 12th, 1 in.; 16th, 2 in.; 25th, 4 in.; June 6th, 7 in.; 13th, 9 in.; 20th, 10 in.; 29th, 12 in.

**Acer Pennsylvanicum*—May 12th, 2 in.; 18th, 4 in.; 20th, 5 in.; 26th, 7 in.

Acer platanoides—May 12th, 3 in.; 16th, 4 in.; 20th, 5 in.

Acer Pseudo-Platanus—May 14th, 6 in.; 18th, 8 in.; 26th, 12 in.; 30th, 13 in.; June 6th, 20 in.; 13th, 23 in.; 20th, 24 in.

Acer rubrum—May 26th, 5 in.; 30th, 6 in.; June 6th, 9 in.; 13th, 10 in.

Acer spicatum—May 18th, 1 in.; 20th, 2 in.; 30th, 3 in.; June 6th, 5 in.; 13th, 6 in.; 29th, 10 in.; July 5th, 11 in.; 11th, 12 in.

Æsculus glabra—May 12th, 5 in.; 14th, 10 in.; 18th, 11 in.; 20th, 12 in.; 26th, 13 in.; 30th, 14 in.

Æsculus Hippocastanum—May 5th, 2 in.; 12th, 5 in.; 14th, 7 in.; 20th, 10 in.; 25th, 13 in.; 30th, 13 in.

Æsculus parviflora—May 5th, 2 in.; 25th, 6 in.; June 6th, 8 in.; 10th, 9 in.; 16th, 10 in.; 29th, 12 in.

Alnus glutinosa—May 14th, ½ in.; 18th, 1 in.; 30th, 2 in.; June 6th, 3 in.; 20th, 4 in.

**Alnus maritima*—May 20th, 1 in.; 26th, 2 in.; June 1st, 3 in.

Alnus serrulata—May 18th, 4 in.: 25th, 8 in.; 30th, 12 in.; June 6th, 13 in.; 13th, 14 in.; 20th, 16 in.

Amelanchier Canadensis—May 12th, 1 in.; 14th, 2 in.: 18th, 3 in.; 20th, 4 in.; 26th, 7 in.; 30th, 8 in.

Amorpha fruticosa—May 12th, 1 in.; 14th, 2 in.; 18th, 4 in.; 20th, 6 in.; 26th, 10 in.; 30th, 11 in.; June 6th, 12 in.

Ampelopsis quinquefolia—May 26th, 14 in.; 30th, 16 in.; June 6th, 24 in.; 13th, 30 in.; 20th, 36 in.; 29th, 38 in.

Aralia spinosa—May 26th, 4½ in.; 30th, 5 in.; June 13th, 5½ in.; 20th, 6 in.

Berberis vulgaris—May 26th, 8 in.; June 1st, 12 in.; 6th, 14 in.; 13th, 17 in.; 20th, 18 in.; 29th, 20 in.

Betula alba, hort. *pendula laciniata*—May 12th, 1 in.; 20th, 2 in.; 25th, 4 in.; 30th, 5 in.; June 6th, 7 in.; 10th, 8 in.; 19th, 10 in.

**Betula lenta*—May 26th, 1 in.; June 1st, 2 in.; 13th, 6 in.; 20th, 10 in.

Betula lutea—May 25th, 1 in.; 30th, 2 in.; June 6th, 3 in.: 13th, 4 in.; 29th, 5 in.

Betula papyrifera—May 18th, 1 in.; 20th, 2 in.; 26th, 3 in.; June 1st, 3½ in.: 6th, 4 in.; 20th, 5 in.

**Betula alba* var. *populifolia*—May 18th, 1 in.; 20th, 1½ in.; 26th, 3 in.; June 1st, 4 in.; 6th, 6 in.; 13th, 7 in.; 19th, 12 in.; 29th, 14 in.

Carpinus Americana—May 25th, 1 in.; 30th, 2 in.; June 6th, 4 in.; 13th, 5 in.; 20th, 6 in.

Carya alba—May 20th, 3 in.; 30th, 8 in.; June 6th, 9 in.; 13th, 9½ in.

Carya amara—May 25th, 3 in.; 30th, 3½ in.; June 3d, 4 in.; 13th, 4½ in.

**Carya salcata*—May 18th, 6 in.; 20th, 8 in.; 26th, 12 in.; June 1st, 14 in.

**Castanea pumila*—May 18th, 3 in.; 20th, 4 in.; June 19th, 12 in.

Castanea vesca—May 16th, 1 in.; 26th, 2 in.; June 1st, 2½ in.; 13th, 3 in.

**Catalpa Kœmpferi*—May 16th, 5 in.; 18th, 6 in.; 26th, 12 in.; 30th, 14 in.; June 6th, 16 in.; 13th, 20 in.; 20th, 24 in.; 29th, 28 in.

Celtis occidentalis—May 18th, 3 in.; June 13th, 10 in.

**Cercis Canadensis*—May 18th, 2 in.; June 29th, 15 in.

Cladrastis tinctoria—May 9th, 1 in.; June 20th, 18 in.

Cornus florida—May 25th, 2 in.; 30th, 2½ in.; June 6th, 3 in.; 13th, 4 in.; 20th, 5 in.; 29th, 6 in.

**Cornus Sibirica*—May 16th, 1 in.; June 29th, 12 in.

Cratœgus Crus-galli—May 9th, 1 in.; June 13th, 7 in.

Cratœgus Oxyacantha—May 12th, 3 in.; June 29th, 22 in.

**Euonymus atropurpureus*—May 18th, 6 in.; June 19th, 13 in.

Fagus ferruginea—May 18th, 2 in.; 26th, 5 in.; 30th, 8 in.

**Fraxinus pubescens*—May 14th, 2 in.; 18th, 4 in.; 20th, 6 in.; 26th, 8 in.

Gleditschia triacanthos—June 1st, 2 in.; 20th, 12 in.

Liriodendron Tulipifera—May 26th, 1 in.; 30th, 2 in.; June 6th, 3 in.: 29th, 5 in.; July 5th, 6 in.

**Maclura aurantiaca*—May 18th, 1 in.; July 10th, 37 in.

Magnolia acuminata—May 20th, 1 in.; June 29th, 6 in.

Philadelphus coronarius—May 12th, 3 in.; June 19th, 19 in.

Platanus occidentalis—May 26th, 1 in.; July 5th, 9 in.

* *Platanus orientalis*—May 18th, 3 in.; 20th, 4 in.; 26th, 8 in.; June 1st, 12 in.; 6th, 16 in.; 13th, 24 in.; 29th, 40 in.; July 11th, 44 in.; 25th, 52 in.; Aug. 3d, 56 in., *still growing.*

* *Populus alba* var. *Bolleana*—May 12th, 2 in.; Aug. 3d, 32 in.

Populus grandidentata var. *pendula*—May 12th, 2½ in.; June 29th, 17 in.

Populus monilifera—May 16th, 2 in.; June 19th, 6 in.

Prunus nana—May 16th, 3 in.; 26th, 5 in.; June 1st, 7 in.

Prunus Pissardi—May 8th, 5 in.; June 13th, 10 in.

Prunus serotina—May 12th, 7 in.; 30th, 14 in.

Prunus Virginiana—May 12th, 3 in.; 26th., 6 in.

Pyrus Aucuparia—May 3d, ½ in.; June 6th, 12 in.

* *Pyrus Malus*—May 9th, 2 in.; 26th, 8 in.

Quercus alba—May 12th, 2 in.; 18th, 6 in.; 26th, 13 in.

* *Quercus bicolor*—May 9th, 2 in.; July 5th, 12 in.

Quercus coccinea var. *tinctoria*—May 12th, 1 in.; June 13th, 7 in.

* *Quercus ilicifolia*—May 14th, 3 in.; June 6th, 13 in.

* *Quercus imbricaria*—May 12th, 2 in.; June 6th, 20 in.

Quercus macrocarpa—May 16th, 4 in.; 20th, 6 in.; 25th, 12 in.: 30th, 13 in.; June 6th, 14 in.

Quercus nigra—May 12th, 5 in.; June 6th, 14 in.

Ribes floridum—May 12th, 2 in.; June 6th, 12 in.

Robinia hispida—May 18th, 2 in.; June 19th, 12 in.

Robinia Pseudacacia—May 12th, 1 in.; 18th, 2 in.; 26th, 3 in.; 30th, 4 in.; June 6th, 5 in.; 13th, 6 in.; 20th, 7 in.; 29th, 9 in.; July 5th, 10 in.

* *Salix Babylonica* hort. *annularis*—May 18th, 1 in.; July 25th, 20 in.

* *Salix Babylonica*—May 9th, ½ in.; 12th, 2 in.; 16th, 3 in.; 20th, 4 in.; 26th, 6 in.; June 1st, 12 in.; 13th, 16 in.; July 11th, 27 in.; 19th, 34 in.; 25th, 40 in.; Aug. 3d, 42 in.

Syringa vulgaris—May 3d, 4 in.; 9th, 8 in.; 12th, 12 in.; 18th, 13 in.; 26th, 14 in.

Tilia Americana—May 14th, 2 in.; 18th, 3 in.; 20th, 5 in.; 26th, 11 in.; June 1, 12 in.; 6th, 13 in.

Vitis riparia—May 14th, 1 in.; 30th, 15 in.

VII. INFLUENCE OF CERTAIN CHEMICALS UPON GERMINATION.—Germination is attended by an evolution of carbonic acid gas, the product of the decomposition of certain ingredients in the seed. If this evolution of gas can be hastened in any manner germination must be hastened. Quick lime, which has a strong affinity for carbonic acid itself, has been used for the purpose of hastening germination; its chemical action upon the seed is not understood, however. Certain other substances which have the ability to decompose water, thereby setting free oxygen which unites with the carbonof the seed and passes off with it in the form of carbonic acid, have also been used with varying success. "A weak solution of alkali quickens the growth of some seeds, and lime-water has been recommended as a steep for cereal, coniferous, and other seeds; but it must be used in a weak state. The secret of success in using lime would seem to be its affinity for carbonic acid which it extracts from the seed, and thus induces a more rapid germination than the application of heat and moisture alone. Humboldt employed a weak solution of chlorine which possesses the power of decomposing water and thus setting oxygen at liberty; and diluted oxalic acid has been successfully used in the case of very old seeds. Camphor has long been said to possess the property of hastening the germination of seeds, and similar properties have been attributed to bromine, chlorine, and iodine. M. Heckel has recently experimented with these substances, and the results go towards proving the correctness of this assertion. Radish seeds, simply moistened with pure water, germinated in eight days; similar seeds, kept moist with iodine water, germinated in five days, with bromine water in three days, and with chlorine water in two days. The monobromide of camphor exhibited even greater quickening energy than either of its constituents used separately, or than a simple mixture of bromide and camphor, germination occurring after a mean interval of thirty-six hours."*

Experiments with the use of various substances as an aid to germination were performed last year and this year. I select two which were conducted with great care by my students. The first, which was published last year,† was conducted by T. A. Stanley of the class of 1886, with results as follows:

Three weak solutions of chlorine and bromine were made, their strength being represented by 1, 3-5, 1-5. There were also made some very weak lime water and a very weak solution of oxalic acid. These various solutions, also pure water, were put in separate bottles, into which different seeds were placed to soak, some for eight hours and some for twenty-four. The seeds were then placed on the surface of sand in small flower pots and covered with glass to prevent too rapid evaporation. The pots were placed in boxes of earth and kept moist by watering the earth about them.

All this was done in the forcing house with no fire, and observations were taken daily, morning, noon and night. As soon as a seed or seeds sprouted record of the fact was made. These observations were continued until most of the seeds had sprouted, but for sake of brevity the time when only the first sprout appeared is here given.‡

In the table, the column at the left shows the kind of solution and its relative strength. The other columns contain the number of days elapsing from the time the seeds were removed from the solutions to the time when the first sprout was seen.

The blanks indicate that no seeds sprouted.

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* Burbidge, Cultivated Plants, 32.

† Mich. Hort. Rep., 1886, 104.

‡ At the time of experimenting, early in May, the weather was very unfavorable for the germination of seeds, and having no fire in the forcing house I had to do with what little heat nature gave.

Solution.		After soaking eight hours.			After soaking 24 hours.		
		Radishes. Days.	Peas. Days.	Cabbage. Days.	Radishes. Days.	Peas. Days.	Cabbage. Days.
Bromine.	One	3	2½	3½	2½	4½	4½
	Three-fifths	3½	2½	3½	3½	5	4½
	One-fifth	3½	2	3½	4½	4½	5½
Chlorine.	One	---------	3½	4½	---------	---------	---------
	Three-fifths	5	3	4½	---------	---------	---------
	One-fifth	3	3½	3¼	4½	---------	---------
Oxalic acid		3½	4½	4½	---------	---------	---------
Pure water		4½	---------	5½	4½	3	---------
Lime-water		---------	1½	3	2½	2½	2½

From the above table it will be seen that in the eight hour series there was a gain of time in the germination of the seeds that had been soaked in the prepared solutions over those soaked in the pure water. The greatest gain was with the lime-water.

In the twenty-four hours' series it is evident that the seeds soaked too long, especially in the chlorine solutions, where nearly every seed failed to germinate. In pure water the radishes and peas did well, while the cabbage, for some unknown reason, failed entirely.

The seeds in the lime-water came out ahead, yet they did not average so well in this instance as in the eight hour series.

From these experiments it appears probable that the germination of some seeds may be hastened by a previous soaking in solutions other than pure water; and that a very weak solution of lime-water has the most marked effect, reducing the time of germination to thirty-six hours. This latter corresponds with the results obtained by Von Humboldt with radish seeds soaked in the mono-chromide of camphor, Being unable to procure this camphor compound, Von Humboldt's experiment could not be repeated.

The second experiment was performed by O. C. Wheeler of the class of 1887. He reports it as follows:

The solutions used were bromine, chlorine, lime and pure water.

The first solution of bromine was pure bromine water, diluted to ten times its volume; the second was the first diluted to twice its volume, or the original bromine diluted to twenty times its volume; the third was the first diluted to three times its volume, or the original bromine diluted thirty times its volume. The original bromine water is taken as the standard in computing the per cent.

The first solution of lime-water was made by thorougly slacking 24.2 grams pure quick lime in two quarts of water. This is taken as the standard solution from which the per cent of the other solutions is computed. The second solution is the lime-water diluted one-fourth its volume; the third solution is diluted twice its volume.

The first solution of chlorine water was made by diluting pure chlorine water to five times its volume, the pure chlorine water being taken as the standard. The second solution was the pure chlorine diluted to ten times its volume.

The third solution was pure chlorine diluted to twenty-five times its volume.

Besides these, pure water was used. As will be seen from the table, the seeds in the water were the last to germinate. In the twelve-hour series the earliest and best results were obtained with the second lime-water; in cabbages, with the bromine-waters; second lime-water and second chlorine-water in peas, with the second bromine-water and the third lime-water in beans, and with the third chlorine-water and ordinary water in radishes. Taken altogether, the best average percentages of germination, irrespective of time of germination, occurred as follows: Second lime-water, 69 per cent; second bromine-water, 65.6; third bromine-water, 63.6; third lime-water, 57.5; second chlorine-water, 55.3; first lime-water, 52; first bromine-water, 50.4; third chlorine-water, 44.6; first chlorine water, 39.7; water, 30.

Solutions.	Strength of the solution: per cent.	Seeds remained in the solution 12 hours.								Seeds remained in the solution 24 hours.							
		Cabbage.		Pea.		Bean.		Radish.		Cabbage.		Pea.		Bean.		Radish.	
		Hours.	Per cent germinated.	Hours.	Per cent germinated.	Hours.	Per cent germinated.	Hours.	Per cent germinated.	Hours.	Per cent germinated.	Hours.	Per cent germinated.	Hours.	Per cent germinated.	Hours.	Per cent germinated.
1. Bromine water	10	48	31	48	100	72	60	48	0	30	32	48	100	72	80	48	0
2. Bromine water	5	48	*a* 2	48	100	72	100	48	72	30	36	48	100	72	60	48	55
3. Bromine water	3	48	60	48	100	72	40	48	74	30	100	48	80	72	0	48	55
4. Lime water	100	48	*a* ½	48	60	72	0	48	48	30	60	48	100	72	60	48	88
5. Lime water	75	48	91	48	100	72	20	48	72	30	69	48	100	72	20	48	80
6. Lime water	50	48	*b* 1	48	80	72	100	48	36	30	64	48	100	72	0	48	80
7. Chlorine water	20	48	30	48	60	72	20	48	0	30	32	48	100	72	40	48	36
8. Chlorine water	10	48	*c* ½	48	100	72	10	48	50	30	72	48	100	72	60	48	50
9. Chlorine water	2½	48	*d* 1	48	*a* 20	72	60	48	80	30	44	48	80	72	10	48	62
10. Pure water	......	48	*e* 0	48	*f* 0	72	40	48	80	30	*g* 0	48	60	72	*h* 0	48	60

a In 72 hours 80 per cent had germinated.
b In 72 hours 70 per cent had germinated.
c In 72 hours 51 per cent had germinated.
d In 96 hours 76 per cent had germinated.
e In 96 hours 52 per cent had germinated.
f In 72 hours 100 per cent had germinated.
g In 64 hours 52 per cent had germinated.
h In 96 hours 100 per cent had germinated.

A series of similar experiments was performed some years since by M. Cary Lea, of Philadelphia, and the results are here condensed for comparison. One of the most satisfactory of Mr Lea's experiments was to ascertain the influence of ozone upon germination.* The seeds were placed upon gauze which rested upon water, the whole contained within a bell-glass. Into two bell-glasses ozone was admitted, while others were filled with atmospheric air. The germination and early growth were less rapid in the ozonized atmosphere than in the other. In the ozone, the young roots extended themselves upwards instead of downwards, became pinkish at the extremities, and soon ceased to grow. On the "twelfth day the experiment was terminated. The average height of the wheat plants not exposed to ozone was ten inches;

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* Amer. Jour., Sci. 2d ser. xxxvii, 373.

of those exposed four inches. The effect of the ozone in checking the growth of the roots was very remarkable, especially with the wheat plants. In those not exposed to ozone, the roots attained a length equal to about one-fourth the height of the stem. In those exposed to it, the roots, after starting, almost immediately ceased to grow. The strongest plant attained a height of six inches and developed six rootlets, averaging only three-sixteenths of an inch in length, while those not exposed to ozone had many roots exceeding two and a half inches. As a whole, the roots produced by the plants under the influence of ozone did not exceed one-tenth of those produced in its absence from an equal number of healthy seeds."

Seeds placed in an atmosphere from which all carbonic acid had been removed germinated as readily as those in atmospheric air. Others placed in an atmosphere of carbonic acid did not germinate, although they afterwards germinated readily when exposed to the atmosphere.

Subsequent experiments were made by the same investigator with various organic and inorganic substances.* In one instance twelve glasses of twelve and one-half oz. water each were prepared with solutions as follows:

1. One drop sulphuric acid.
2. Two drops nitric acid.
3. Three drops hydrochloric acid.
4. Five grs. bicarbonate of potash.
5. Five grs. dry carbonate of soda.
6. Ten drops of rather weak liquid ammonia.
7. Five grs. bromide of ammonia.
8. A pair of zinc and copper plates connected above the surface by a wire and plunged in plain water.
9. Same, acidulated by three drops hydrochloric acid.
10. Plain water for comparison.
11. Five grs. sulphite of soda.
12. Five grs. chlorate of potassa.

A thin muslin was placed over the liquids so as to dip into them, and on this were placed in each case, twenty grains of wheat. The most rapid germinations during a period of six days occurred in solutions Nos. 4, 10, 11. At the end of the sixth day the poorest results were obtained from Nos. 1, 2, 3, 9. The following table shows the per cent of germination, and the proportional amount of vegetation at the end of seven days:

Solution.	Number of seeds that germinated out of twenty.	Proportional am't of vegetation, taking that in plain water as 100.
No. 1	18	16.8
" 2	14	8.7
" 3	3	2.8
" 4	16	100.0
" 5	14	65.6
" 6	13	60.9
" 7	11	48.1
" 8	16	65.0
" 9	8	10.0
" 10	16	100.0
" 11	12	75.0
" 12	13	20.3

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* Amer. Jour. Sci. Ind. Ser. xliii., 197.

In another instance, nine solutions were prepared in similar vessels, as follows:

1. Plain water.
2. Cane sugar, thirty grs.
3. Gum, thirty grs.
4. Glycerine, one fl. drachm.
5. Sulphuric acid, one-fourth drop.
6. Citric acid, five grs.
7. Sulphite of soda, twenty grs.
8. Permanganate of potash, two grs.
9. Nitrate of ammonia, twenty grs.

At the end of thirteen days, during which the weather was very cold (Dec. 10 to 23), the following was the condition of affairs:

"Nos. 2 and 4 were as far advanced as the plain water (No. 1), but no further. These substances therefore had not stimulated either germination or early vegetation in the wheat seeds.

"In No. 3 fewer seeds germinated than in either of the foregoing, but the most advanced plants were fully one-half higher than any in Nos. 1, 2 or 4.

"Nos. 7 and 9 were somewhat in advance of those in plain water, but not very much.

"In No. 6 a large number germinated and appeared healthy, but they did not obtain one-fourth the height of those in No. 1, and, what was very remarkable, they formed no roots at all.

"In No. 5 the plants were more advanced than in the citric acid (No. 6), and had healthy roots extending down into the liquid.

"In No. 8 the condition of affairs most resembled that in the citric acid. In both the seeds had germinated and produced healthy looking plants an inch in height, but no roots whatever had been formed in either case.

"Those plants which grew in the vessels containing solutions of cane sugar, gum, and glycerine, respectively, grew as fast and flourished as well as those in plain water, but it could scarcely be said that at the end of the month they presented any superiority."

M. Albert Larbalètrier* has recently experimented upon seven agents in the germination of wheat: quicklime, sulphate of soda, permanganate of potash, sulphate of copper, sulphate of ammonia, sulphuric acid, and salt of lead [acetate of lead?]. The salt of lead produced the first germinations, thirteen out of a hundred grains sprouting in three days. Permanganate of potash was second in influence. In the final results, with percentages of germinations, the salt of lead was most beneficial. The following are the best percentages of germination in eleven days after sowing:

Salt of lead,	99.
Sulphuric acid,	80.
Permanganate of potash,	75.
Sulphate of copper,	74.

In conclusion it may be said that in a practical way the results of all experiments here detailed concerning the hastening of germination by chemical means are unsatisfactory except in the instance of lime-water, bromine-water and chlorine-water.

But however uncertain our knowledge of the agency of chemicals in hastening germination, we have many definite facts concerning the retarding or prevention of germination by many alkaline, saline and acid substances. "Nessler found, for example, that most saline solutions that are stronger than 0.5% are hurtful, both for seeds and for young plants that have just sprouted. Thus, a 0.5% solution of common salt prevented the germination of clover, rape, and hemp seeds, though a solution so weak as this did not prevent wheat from germinating. A 1% solution of the salt, however, prevented all but a few grains of wheat from germinating, and the sprouts that did start soon perished. Hemp seeds were injuriously affected by a solution of salt that contained no more than 0.25%. When moistened with a 1% solution of sulphate of ammonia, wheat seeds germinated, but the young plants would not grow, not even when the solution was only 0.75%. A comparatively large number of seeds germinated when wet with a 10% solution of sugar, but the growth of the young plants was hindered even by a 0.5% solution of it. Ferrous sulphate (copperas), even when its solution is no stronger than 0.05%, has an injurious effect, both on germination and on the further development of seeds that have already sprouted." *

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* Le Cocq de Lautreppe in Country Gentleman, Nov. 10, 1887, 852.

"Alkaline borates and silicates were found to retard germination, even when used in relatively small proportions, stronger solutions checking germination for an indefinite period. Arsenious acid and the soluble arseniates prevented germination altogether by destroying the germ or embryo." † Blue vitriol has been found by Professor Henslow of England to possess no injurious influence upon the germination of wheat.

These results are valuable as indicating the limit of danger in the use of substances sometimes employed as fungicides and insecticides. Nessler's results with solutions of common salt are not fully confirmed by a series of careful experiments conducted at this college by W. K. Kedzie. ‡ These experiments were undertaken chiefly to determine how much steeping in brine could be endured by wheat with the object of destroying the rust. With saturated solutions it was found that as high as 96% of the seeds germinated. The following table presents the results of one trial, the brines being kept at a temperature of 62° Fahr., 30 seeds of Diehl wheat being used in each instance:

Percentage of salt in solution.	Length of time the seeds were allowed to soak.	No. which germinated.
35 per cent	5 minutes	26
35 " "	20 "	29
35 " "	1 hour	28
35 " "	2 "	26
35 " "	18 "	21
25 " "	1 "	18
25 " "	5 "	22

"Grains were steeped in saturated brine [35%], also in brine of 25 per cent., at an average temperature of 200° Fahr., for periods of 30 minutes, 40 minutes, 2 hours, and 5 hours, and in every case every grain was destroyed. An examination of the steeped grains revealed the germinating principle utterly destroyed. * * * * * An attendant phenomenon in the steeping of grains was the slow destruction and solution of the protective covering of the grains." The strongest brines, not hot, produced a very

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* Storer, Agriculture, ii. 395.
† Experiments of Heckel, quoted by Burbidge, Cult. Plants, 32.
‡ Rep. Mich. Board Agr. 1869, 190.

weak condition in the young seedlings, so that the percentages of germination do not represent the value of the experiments. It is concluded that "the use of strong brines on seed wheat cannot be regarded as otherwise than somewhat hazardous. But as the brine needs simply to come in contact with the smut to destroy it, the bad effect on the wheat may be reduced to a minimum. If a saturated brine be diluted with one-third water, making a solution of 28 per cent., it may be used with comparative safety. * * * * * The popular custom of sifting on the grains, after soaking, lime, ashes, and plaster, is quite a safeguard against the pernicious effect of the brine, from their powerful drying and absorbent properties. * * * * * Oats are so generously provided by nature with a thick, warm, fibrous covering that no soaking in saturated brine seems to exert any influence. * * * * * In saturated brines, grains of barley seem to be even more susceptible to harm than the grains of wheat, an hour's soaking destroying about half; but if the saturated brine be diluted about half, making a solution of 18 per cent., the peril is entirely done away with."

VIII. AN EXPERIMENT IN APPLE CULTURE.—The college apple orchard, originally comprising about nine acres, was set in 1858. The original plantings were mostly Northern Spy, Baldwin, Talman Sweet and Seek-no-further. The soil is a strong sandy loam, in some parts inclining to be cold and wet.

The orchard has received various treatments. For nearly ten years, beginning about 1873, careful and valuable experiments in culture were carried on by Dr. W. J. Beal.* In recent years the orchard has received less attention, being allowed to stand in sod. It has borne very few good crops, even from the first.

In 1885, when the immediate control of the orchard passed into the hands of the writer, the trees presented a discouraging appearance. The previous hard winter had destroyed many of the largest trees on the lower land. Most of these trees were Baldwins, Greenings and Fall Jennettings. In fact, there is only one Baldwin left in the orchard and but two or three Greenings and Jennettings, and all are feeble. Many or all of these trees had been injured by a hard winter some ten or twelve years before. The remaining trees of the orchard, apparently from neglect in culture, were feeble during the year, the leaves presenting a yellow and sickly appearance. Many of them appeared to be dying. All the trees were very much stunted, there not being enough last year's wood on most of them to furnish even a few good scions. Many of the main limbs had died back from the ends and the dead portions were conspicuous in every direction. The trunks were often mossy and rough. The tops were for the most part very thick and low, so that no attempt at thorough culture could be made. Most of the orchard lay in a dense June grass turf. In short, the orchard was in so poor condition that several careful farmers recommended that it be cut down.

The first work of renovation was to prune the trees. This was done vigorously in May, 1885, the tops being made high enough in every instance to allow the passage of a horse in harness. All limbs, irrespective of size, which would interfere seriously with plowing and cultivating, were removed. At the same time the tops of the trees were thinned considerably, though not to such an extent as to allow the sun to beat continuously upon the main branches. The trunks and main limbs, so far as a man could reach, were scraped, all the loose bark and "moss" being removed. This scraping was performed solely for the purpose of making the trees look better. It is a common observation that the most successful orchardist is the tidiest one. Care was taken not to scrape into the live bark. The implements used for this purpose were old, well-worn hoes with the handles cut off about two feet from the blade. This implement should be held loosely in the hand, else it will scrape too hard.

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* For results of these experiments, see Reports State Board of Agriculture, 1873, p. 47, 1874, p. 53, 1876, p. 119, 1877, p. 48, 1878, p. 72, 1880, p. 48.

As soon as the pruning was accomplished and the great quantity of brush removed, the ground was plowed, and plowed as deeply as possible. To be sure roots were broken, but this did no harm. The ground was cultivated at intervals with the spring-tooth harrow, and in August a second plowing, in the opposite direction, was made. No crops were planted. There was no effect produced upon the trees that year. The season's growth, if any, was well under way when the first plowing was made. The leaves continued yellow, and fell very early, as usual.

In 1886 the same treatment was repeated. Nearly as much pruning was done as in the previous year, this time, of course, entirely in the tops of the trees. Care was exercised, however, not to prune the tops so thin that the large limbs would be injured by the sun. The trees early showed signs of improvement. Although the summer was dry, the growth on all the trees was good and the leaves assumed a dark, vigorous color, and remained very late upon the trees. So marked was the improvement in the orchard that it was a subject of common remark. A fair crop of apples, some 300 bushels, was also gathered.

In the spring of 1887 the orchard was again plowed, deeply as always before, and the sod was removed from all the trees by hand. The tops are now so high that the plow turned over nearly all the sod. The ground was now in good heart. The trees set very full of fruit, and no pruning was attempted. Although the trees have borne a heavy crop, and the season has been one of almost unprecedented drouth, the growth has been heavy. The bearing trees are 140 in number, of which less than 100—all Northern Spy—are a prolific variety and produced apples which find a demand in market. There are a number of Sweet Romanites and others which can not be expected to return a profitable crop. The sales for the year have been as follows:

274 bbls. No. 1 (822 bu.) @ $1 35	$369 90
100 bbls. No. 2 (300 bu.) @ 75	75 00
60 bu. @ $0 25	15 00
100 bu. @ 30	30 00
220 bu. made into cider @ $0 20	44 00
300 bu. cider apples @ $0 05	15 00
1802 bu	$548 90

The reason for the great proportion of cider apples is the heavy crop and the drouth, rendering it impossible for all the fruit to mature. Thinning would probably have paid. The crop was remarkably free from worms. Old apple buyers declared that they had never seen so few wormy apples in a crop. This freedom from insects was due to sprayings of Paris green. Field's force pump, manufactured at Lockport, N. Y., for about $30.00, was used for this operation. It is a double-acting pump and is geared from a hind wheel of the wagon. A rough platform was made for the wagon, and upon this a kerosene barrel, with the pump attached, was securely fastened. One man drove and one handled the hose, which is about ten feet long. One side of a row can be sprayed at a time, and if the wind is right there need be little inconvenience about the work. We experienced some difficulty in getting the motion right, but it was finally adjusted so as to be perfectly satisfactory. The motion must be tolerably rapid so that the team shall not need to hurry by a tree too quickly. The hose nozzle which came with the pump—the "Boss" nozzle--we found to be almost worthless, as it did not spread the stream well. A flattened nozzle is much more satisfactory. We also felt the need of a handy and rapid shut-off, in the case of vacant places in the orchard. This we supplied. Otherwise the machine was entirely satisfactory. It has an attachment which constantly agitates the water in the barrel, keeping the Paris green in suspension. There are many hand force-pumps which can be procured cheaply, and which will answer all the purposes of this pump for small orchards. We shall endeavor to use this pump for spraying potatoes. We used a half-pound of Paris green to a kerosene barrel of water. In one instance we used three-fourths of a pound, but the liquid injured the foliage.

The apple industry is undoubtedly diminishing in many parts of the State. The old orchards are beginning to fail and new ones are not being set to any extent. Although prices for apples have been low for the last few years, there is every reason to believe that an orchard of moderate extent if intelligently managed, will add a reliable source of income to the general farmer. There are hundreds of orchards throughout the State which are not bearing but which could be brought into fruitfulness for a number of years by vigorous culture. There is no doubt but that judicious pruning, good tillage and liberal manuring will maintain or restore the fertility of most orchards. Some orchards are now, of course, too old to rejuvenate. There may be danger in vigorous orchards of carrying the cultivation so far that nearly all the energies of the trees will be directed to the production of wood. The grower must determine the culture which shall meet his requirements. It is true that in the great majority of cases, however, the culture is inadequate. Barn-yard manure, when it can be spared, is valuable for the bearing orchard.

Permanent sod is an injury to the orchard. This has been proved in the experience of nearly every successful orchardist. It is forcibly illustrated in the instance of the old College orchard. In the earlier experiments conducted by Dr. Beal the same fact was emphasized. For some years he kept a part of the trees in sod, others were cultivated thoroughly, while still others were cultivated at varying distances from the body of the tree. Even as early as 1874 he found that "trees in grass made less growth, looked yellow in foliage, and bore smaller fruit and apparently less of it." In 1875 he observed that "the evidences look more and more strongly every year against the propriety of leaving trees, in our section, in grass. They have stood the severe winters no better; they have borne no better; the apples are smaller; the trees grow more slowly; a greater proportion of trees have died than of those cultivated each year. So marked have been the results that we have plowed up about half that part of the orchard which was left in grass."

IX. MISCELLANEOUS NOTES.--1. BUD VARIATION.—A bud-variety is a form or variation which suddenly appears upon some branch of a plant. The phenomenon is known as bud-variation. Darwin was one of the first to present a catalogue of bud-varieties and to discuss them in a scientific manner. Well-known examples of bud-variation are the appearing of the nectarine upon the peach tree, yellow cherries upon red-fruited trees, weeping or drooping branches upon trees of upright growth, etc. The causes of these singular phenomena are unknown. Many of our choicest varieties of ornamental plants and some of our fruits originated in this manner. Bud-variations of greater or less degree are common, and are known to all good observers. It is probable that the anomalous apples, which occasionally appear, partaking of the external character of some very different sort, are bud-varieties, and not the immediate effects of cross-fertilization, as is commonly supposed. Certain it is that artificial crossing will rarely, if ever, produce the distinct bands of color which are often seen in these sports. It is not an uncommon circumstance to find russeted apples upon a Rhode Island Greening tree, or a fruit of a normally white-fruited variety marked with definite zones or sections of red or brown. The singular and pleasing diversity of color which is often displayed in autumn among the branches of the same tree should probably also be referred to bud-variation. It is probable that these colors are often characteristic of the same branches year after year. One of the most marked cases of bud-variation which ever came under my notice was observed this year upon a tree of Onondaga pear. One branch, so placed as to remove all possibility of its being a root-sprout or a graft, bore about a dozen pears which were intensely and uniformly russeted. They were so different in appearance from the pears upon the remainder of the tree that no one would suppose for a moment that they were the same variety. Even the Sheldon does not differ more widely from the Onondaga in appearance than does this singular sport. Trees will be propagated from each part of the tree.

A very striking bud-variation was observed last year in a bunch of grapes. The grape was one of the hybrids obtained by Mr. George Haskell of Ipswich, Mass. (No. 95). The larger part of the bunch bore fruits of the ordinary size and the ordinary, almost insipid flavor, but one branch of it bore fruits about half as large, with thinner skin, an entirely different and better flavor, and seedless. In fact, these small grapes were as good as the Deleaware. A drawing of the cluster was made and was sent, together with various notes upon Haskell's hybrids, to an agricultural journal, but the manuscript was lost before reaching the press. As I neglected to preserve other notes, I cannot give measurements.

Bud-variation is not sufficiently known among horticulturists. It is a subject of great practical importance, it occurs to me. To indicate the direction of bud-variation in grapes, I translate the following from Carrière's suggestive *Production et Fixation des Variétiés dans les Végétaux*, a work which appeared before the publication of Darwin's remarks on bud-variation:

"Bud-variation is comparatively common in the vine. It is well understood in this case, as the vine is one of the oldest of cultivated plants and as it is multiplied almost always by cuttings; and as cuttings are made by millions each year a bud-variety soon becomes widely disseminated. It frequently happens that a shoot will produce grapes differing in form or color from those which are borne upon other shoots of the same vine. We may add that these variations nearly always present peculiar qualities also. We will cite examples.

"Upon a plant of black-fruited Muscat grape we have observed for several years that some shoots produce white grapes.

"The white seedless Corinth is a bud-variety from a variety which has much larger fruits with seeds. This is a fact which we have several times observed upon bunches where some fruits were unusually developed and which contained seeds. The White Corinth is analagous to the *Chesselas de Demoiselles.* Like this, it is the result of a lack of fertilization of the flowers.

"A proprietor of large vineyards in the middle of France, the late Cazalis Allut, wrote some years ago as follows:

"'A stock of *Téret* produced with me, for several years, black grapes upon shoots of two of its arms, and grey grapes upon shoots of the other arms. A stock of *Epiran gris*, trained in cordon, is now about forty feet long. The first twenty feet produce constantly grey grapes and the remainder produces white ones. I have in an enclosure a stock of *Epiran noir* having several arms. The shoots of one of the arms give grapes almost twice as large as those on other parts of the vine.'

"Another viticulturist, M. Henri Bouschet of Montpellier, wrote very recently:—

"'I have had occasion for several years to use in my collection at Lot-et-Garonne, a plant of *Prunella gris*, which, sometimes upon one stem, sometimes upon two, bore black grapes, while the remainder of the vine bore grey ones. I have noticed for two years in my collection at Calmelte a most curious fact upon three grafts of a Spanish variety which came to me from the collection of Luxembourg, where it is called *Parrel del Reyno de Lorca* and which I have recognized as our *Morastel noir*. One of these three stocks has borne on one side, to my great surprise, black grapes exactly similar to those of the *Morastel*, and upon the other side, constantly, white bunches having an appearance very different from an ordinary white *Morastel*, and presenting a foliage very different in size and form. This odd foliage appears to me to be identical with that of the *Oyo de Rey de Morada*, of which the leaves, bright yellowish-green, present very shallow rounded dentate lobes, while the leaves of the Morastel are deep green with deep divisions, the lobes acute, with teeth detached and terminating in a point.'

"A passage which we find in the *Parfait Vigneron* (edition of 1811) seems to confirm entirely the opinions which we give concerning bud-variations in grapes:—

"'A citizen of Vilmorin has observed a stock of *Meunier* to bear, upon some shoots, leaves and fruits of *Maurillon précoce.* A citizen of Jumilhac has seen likewise the *Meunier* become *Maurillon.*'

"Therefore the grape called *Madeleine, Juillet, Maurillon hâtif,* etc., is only an accident from *Meunier*, a fact which shows, as we have said before, that the varieties produced by bud-variation can present qualities different from those presented by the plants from which they come.

"Upon a plant of *Pinot gris* there appeared at the museum in 1863 a shoot whose leaves were much variegated or striped with yellow. It produced a grape very similar to the variety from which it came. It appeared to be much less fertile, however.

"In 1863 we observed two other very remarkable examples. One example refers to the *Précoce Malingre,* the other to the variety designated by the name of *Verjus*. These examples present contrary results. Thus, while *Précoce Malingre* has long oval fruits, scattered, and the bud-variety which appeared upon it had round fruits borne close together and larger than those of the type, the *Verjus* has slightly oblong or nearly spherical fruits and the bud-variety which was developed upon it had fruits long-oval and attenuated at both ends, and somewhat later than those of the type.

"The *Chasselas gros Coulard* is a bud-variety which appears frequently upon the ordinary Chasselas. Its fruits are large and spherical. They often drop. It differs especially from the Chasselas by its stronger shoots with joints much closer together, and by its leaves being less lobed, a little longer and thicker, of a glossy green as if varnished. It differs also from the ordinary Chasselas in its temperament. It needs much heat and also shelter from the influence of the air. It generally succeeds well in forced culture.

"The *Chasselas de Demoiselles,* remarkable for its fruits which are scarcely larger than shot, is a bud-variety from the ordinary Chasselas. This phenomenon appears to be due to the partial abortion of the sexual organs and particularly of the anthers, whence results the lack of impregnation of the flowers and the consequent abortion of seeds. Propagated by cuttings, it preserves its characters. A variety with variegated leaves has appeared from the ordinary Chasselas."

For further notes upon bud-variations the reader is referred to the following notes upon potatoes.

2. BRIEF POTATO NOTES.—Several new varieties of potatoes have been grown in the College garden. Brief notes respecting a few unnamed sorts are here appended.

In the spring of 1886 the Department received from the National Department of Agriculture a packet of potato seeds labeled "Pringle's Hybridized Potato Seed." We wrote Mr. Pringle as to the history of this seed, and had reply to the effect that the seed was not the result of hybridization* but of crossing "amongst several of our best varieties of potatoes." The seed was sowed, and three or four bushels of tubers were raised the first year. These tubers were very variable in size, shape and color, but they fell readily under six general divisions:

1. Long, red.
2. Round, red.
3. Long, dark purple.
4. Round, dark purple.
5. Long finger-shaped, white.
6. Round, white.

Separated in this manner, the tubers were planted this year. The crop of each appeared to follow the parent tubers very closely. All yielded well, but the tubers were very small, owing, no doubt, to the drouth. No. 6 is larger than the other sorts, and resembles the old Peach-blow.

The Mexican or Central American potato has been grown at the College for about ten years. Dr. W. J. Beal received the tubers, the largest about an inch in diameter, from Harvard University. They increased steadily in size, some three years ago the best tubers measuring three inches in diameter the longest way. This potato is apparently a wild form of the common potato. It grows luxuriantly and produces balls in abundance. A few tubers were sent to three farmers in different parts of the State for trial. Mr. L. D. Watkins, Manchester, writes as follows:

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* A hybrid springs from the union of two distinct species, while a cross springs from the union of varieties of the one species.

"The potatoes were planted on first-class farming land, and treated the same as other potatoes. The total yield was twenty-seven and one-fourth pounds [three or four tubers were sent him]. They grew until frost killed the vines. They did not blossom. The five largest tubers weighed twelve ounces. Baked, our verdict is that they are of good flavor."

Mr. W. E. Hale, Eaton Rapids, reports as follows:

"The wild Mexican tubers were planted about May 12, in a sandy loam, which had been well manured. We cut them the same as other potatoes, placing one and two pieces in a hill. The dry weather did not appear to injure them as much as it did the other kinds, yet it was so dry that they did not do much until the fall rains came. There were a good many in a hill, but all of them small, yielding about a half peck in all."

Mr. C. F. Wheeler, Hubbardston, writes:

"The tubers of the wild Mexican potato sent by you May 7, '87, were planted May 13, in light, sandy soil which had received a good dressing of wood ashes. The tubers were cut into pieces of two eyes each and planted in hills eighteen inches apart, into which was placed a half shovel full of well rotted compost. The plants grew finely, making a large growth of tops, which are not to be distinguished from our cultivated varieties. The Colorado beetle made no distinction. The tops were thrifty and green until destroyed by frosts. When dug there were eighty tubers from thirteen hills, the largest of which only measured one and one-half inches in diameter, and altogether weighed sixteen and one-half ounces. They grew at the ends of short, underground stolons, and are very like our common potatoes in appearance."

The Arizona wild Potato is a distinct species from the potato of our gardens. It is known as *Solanum Jamesii.* The foliage is fine and peculiar, very unlike that of the ordinary potato. The tubers are very small, dark colored, and usually covered with minute tubercles. Under cultivation it does not yet appear to vary much, although Dr. Beal informs me that many of the tubers he grew this year were somewhat larger and smoother than the parents. Last spring tubers of this singular potato were sent Mr. C. A. Sessions, of Mears, who reports that the drouth prevented the formation of any crop, and to Mr. C. F. Wheeler, who reports as follows:

"The foliage of Solanum Jamesii is very much like the tomato, except that the leaves are smooth. Its small pitted tubers grow at the ends of long subterranean stolons, setting early, and yielding from ten hills ninety-five small tubers, which weighed eight and one-half ounces. The severe drouth negatived the experiment."

Solanum Maglia was also grown this year. It was in blossom when killed by frost, September 23. We obtained a few very small tubers.

The singular Peruvian ulluco (*Ullucus tuberosus*), which produces potato-like tubers, was also grown.

Many questions are asked concerning the variations of tubers in the hills. In order to answer some of these inquiries and to publish facts not generally known, I translate the following selection from Carrière's *Production et Fixation des Varieties dans les Végétaux:*

"Potatoes furnish many examples of bud-variation. Many of our cultivated varieties are bud varieties from the subterranean parts. Every year at digging time, if we wish to keep the varieties true, we are obliged to throw out those which, we say, are 'degenerated.' This so-called degeneracy constantly tends to remove the products from the starting point, and has, then, the result of producing new varieties.

"Modifications in potatoes can also have reference to the manner of vegetation or growth of the underground parts. Such is the case in the variety called *Pouse-debout* ['tubers standing on end']. This name was given the variety because the tubers, instead of lying horizontally, or nearly so, are placed upright, one against the other, much as small pieces of wood are arranged for the making of charcoal.

"The *Marjolin* we consider nothing else than a peculiarity of vegetation. This is proved by the fact that its characters,—not blossoming and maturing very early,—are not constant. It has produced two other varieties by modifications of its underground parts. One variety is the *Marjolin tardive* [late Marjolin], called also *Marjolin de deuxième Saison*, which is sometimes sold in the Paris markets for the *Hollande jaune* [yellow Holland]. It is remarkable for the period of its growth, which is more prolonged than that of the type, and it is also covered each year with flowers, while its parent scarcely ever blossoms. The other variety has no resemblance to the *Marjolin* in form. It is round and its sunken eyes give it exactly the appearance of the ordinary yellow potato. When we cultivated the *Marjolin* there was not a year when we did not obtain round ones, although we had planted long ones very true in appearance.

"A very remarkable example of the modifications furnished by the ordinary yellow potato, is the following: In a square planted exclusively with this variety, very true in appearance, we gathered a certain number of which the skin was more or less dark; some had yellow flesh, others white. Planted separately, these bud varieties have given us potatoes round in form like the parent type, but among which there were found some entirely violet in both exterior and interior, and some had black flesh slightly marbled with white. This modification of color was not the only change. In some cases the quality was very much modified. Thus, instead of being nearly like the yellow potato, the flesh of these varieties was compact, neither good nor bad.

"We give two other examples of bud-variation in potatoes, observed by us at the Museum * in 1864:

"Half of a plat was planted with the smooth long yellow called *Hollande*, and half with the regular long red commonly called *Vitelotte lisse*. The first half yielded tubers similar to those which we had planted. The second half, on the contrary, produced tubers differing from the parent in color, being of a reddish yellow, although the form remained about the same. The quality, also, did not vary, so that while we confounded them sometimes with the *Hollande*, we were able to distinguish them readily when cooked, as they remained whole, while the others fell to pieces.

"On the end of a plat where we had planted fifty of the ordinary round yellow potato, one plant grew until late in the season and gave round potatoes of a deep red.

"In this same year, 1864, in a square planted entirely to *Chardon* potato, we observed some plants exactly similar to the others in growth and appearance but which differed entirely in the color of the flowers, being dull white, a little sulphur-colored, while those of *Chardon* are violet-rose or rose-violet. The tubers from these white-flowered plants differed from those of the type in being more round and regular and having less pronounced eyes. Aside from these variations we have found among the Chardon both earlier and later varieties, and this in spite of the fact that we had planted only such tubers as appeared to be entirely true and which for a long time had produced no variations whatever. Here, as in the preceding cases, the modifications were from the tubers, seed not having been sown.

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* Muséum d'histoire naturelle, Paris.

"An instance similar to the above is reported by M. Joigneaux in the *Journal de la Ferme et des Maisons de Campagne :* Nine or ten years ago six beautiful tubers of a long, pale yellow potato were given us. In order to increase the number of hills we divided each tuber into three pieces. We planted them ourselves. The cultivating was also done by us. Some of the potatoes, a very small number, resembled the type, but the larger number were spherical, some yellow like the parent, others deep red.

"All cultivators know that the smooth or even *Vitelottes,* whose eyes are few in number and scarcely perceptible, often produce tubers of various forms and with eyes so much sunken that it is almost impossible to peel them. Once we obtained a variety which, besides of the many and deep eyes, produced, in considerable quantity, agglomerations which gave to the whole a monstrous form. They were veritable hydras. Although coming from the *Vitelotte,* which is a good potato, this variety was very acrid and bad.

"All these examples show without any doubt how a large part of the varieties of potatoes are produced, and proves that they do not all come from seeds. We shall convince ourselves of it when, having observed the growth of the plants, we mark the peculiar plants and gather separately their tubers. An external modification is always the consequence of an internal modification.

"The phenomena presented by potatoes prove that the cause of the appearing of new varieties is not always due, as we generally suppose, to crossing, as fecundation can act only upon the seeds. It is also very rarely that we practice crossing in potatoes, but we can number the varieties by the hundred. But it often happens that cuttings made from portions of the top of the plant produce varieties different from the parent. Moreover, the existence of numerous varieties of certain plants which we cultivate and which never produce seeds, proves beyond a doubt that there are causes aside from crossing which tend to the production of new varieties."

3. NOTES ON CROSSING AND HYBRIDIZING.—There has been much discussion of late as to whether the effect of foreign pollen is visible in the fruit of the current year. In order to satisfy myself upon this and other points, an extensive system of experiments was planned. A lack of time to give the matter personal attention made the investigation impracticable, however, and I have to report but a few isolated experiments. These few were performed in the most careful manner possible. The flower buds were opened and the flower emasculated before any pollen could have reached the stigma. The pollen was also secured from flowers which were still in the bud, or which had been covered to exclude all foreign pollen from falling upon the anthers and becoming mixed with the pollen intended for use. The pollen was applied to the stigma by the aid of a thin knife blade. I have never used a camel's hair brush, so often recommended, from the fear that foreign

pollen might lodge in it and be unintentionally applied to the stigma. If the pollen was carried any distance, even a few feet, the flower was placed in a tin cup with a tightly-fitting cover, and the pollen removed from the anthers at the moment of its application. Before the tin cup was used for other flowers it was thoroughly washed. I consider it unsafe, in critical experiments, to hold in the hand the flower which is to furnish the pollen while the operator is emasculating the other flower, especially if under a tree full of blossoms. In short, is is nearly as important to protect the anthers from receiving foreign pollen as it is to protect the stigma. As soon as the pollen was applied the flower was securely and tightly covered with a thin manilla bag which was left on four or five days. A label was attached to the crossed flower, hung upon its stem, and at the same time exact notes of the time, place and conditions of the operation were made. Even if the label were lost or was designedly removed, it was easy to identify the flower. In the case of pears and apples I clip off the flower bud so low as to remove the sepals; as a consequence, the crossed fruit can be recognized at any time during the season by the absence of the "calyx." With all the care possible many crosses will fail to take. Just the reason for such failure, in plants which have an affinity for each other, it is not easy to determine. I am convinced, however, that in the case of annual plants at least, a protracted drouth interferes with fertilization. I was especially impressed this year with this fact in the cucurbits and daturas. In fact, squash growers know that vines do not set fruits so profusely in a drouth as at other times.

About twenty crosses and hybridizations were made upon apples, only eight of which were successful. May 11 five flowers of Hyslop crab were crossed with Oldenburgh. Four fruits set, but in a month two were destroyed by some means unknown. The two remaining fruits ripened, but although the cross was so violent, they differed in no respect from other fruits upon the tree. These fruits are before me as I write (Nov. 4), in a good state of preservation, showing that crossing with an early apple did not influence their keeping qualities.

Five flowers of the Chicago crab were crossed with Sweet Romanite, a winter apple. Four of the pistils were removed in each flower, the remaining one being fertilized. All the fruits set, although one was feeble from the first, and soon fell. An examination of this specimen showed that none of the cells had been fertilized. Two of the remaining four matured, but they differed in no respect from the other crabs upon the tree. Singularly enough, however, seeds developed in but one cell, showing that each style is a means of fertilizing its own cell alone. The mature fruits were somewhat unsymmetrical, being a trifle larger upon the side which bore the seeds. These fruits, with seeds intact, are now peserved in alcohol.

Reciprocal hybridizations were made between apples and the flowering crab, *Pyrus floribunda*, but none of them were successfnl. A Northern Spy flower was hybridized, and for a time the operation appeared to be successful, but the young fruit soon lost vitality and gave evidence that fertilization had not taken place. At apple picking time, in September, this fruit, dried and shriveled, and no more than a half inch in diameter, still clung to the tree.

A few crosses were performed between pears, one of which was successful. This was a Louise Bonne crossed with Howell. The resulting fruit was very singular, being more slender than Louise Bonne, with a very long, thick lower portion, and ripening tardily with almost no color. I cannot ascribe this peculiar variation to the influence of the Howell pollen, as it was in an entirely opposite direction, it seemed to me, from what should be expected from the shape of the Howell itself. The lateness and greenness of the fruit suggested imperfect fertilization.

Many hybridizations were made between *Datura Stramonium* and *D. inermis.* The former of these, as all are aware, has very thorny fruits—the ordinary Jamestown or "Jimson" weed—while the latter has entirely smooth fruits or pods. As most of the operations were performed during our protracted drouth, they were unsuccessful. The later operations were more successful, and seven fruits matured, or so nearly matured before killed by frost that their character was assured. There is not the least evidence of immediate effect of pollen in any of them. The daturas cannot be used with fairness, however, for the determination of the vexed question of the immediate influence of pollen, from the fact that the character of the surface of the ovary is determined before fertilization takes place.

Many crosses and hybridizations were attempted with the cucurbits, but, owing to the dry weather, few succeeded. The ovary often swelled for a day or two, then remained stationary for a couple of days, and then withered, showing that fertilization had not taken place. Only four fruits were fertilized. These were yellow crook-neck squshes crossed with the white scallop. Although the two parents are so extremely unlike, the crossed fruits differed in no particular from ordinary crook-necks. Several attempts were made to cross the white scallop with the crook-neck, at the time that the opposite crosses were made, but without success. It is obvious that cucurbits as a rule, if, indeed, under any circumstances, do not exhibit any immediate effects of pollen, for the fruits which are evidently crosses, in any patch, are always found to be borne upon a vine which bears exactly the same fruits throughout. This circumstance proves that the variation is an outgrowth of the character of the original seed which impresses its nature upon all the fruits which spring from it. If squashes show the immediate influence of pollen we should certainly find fruits of varying character upon the same vine. Abnormal fruits which are intermingled with others throughout the patch need only to be carefully traced to their support in order that their origin may be determined.

4. WHICH FLOWER IN THE CLUSTER MAKES THE APPLE?—Apple flowers are borne in clusters, yet the apples are usually borne singly. As a rule, all the flowers but one must fail. If one is to perform crossing or hybridizing it is important that he know which flower to operate upon. With a view of determining this flower I made a few observations last spring. In general, the central flower was the strongest and made the fruit, yet in many cases the central flower was the weakest. In eight clusters of Fameuse flowers, the central flower, which was in these instances the largest in the cluster, was removed. One cluster alone failed to set fruit. Of the remaining seven, four clusters set two fruits each and three clusters set one fruit each. Upon the same tree two clusters were marked in which the central flower was very small and late. Each cluster set one fruit, the central flower not developing. I conclude from a general observation that any well-developed flower in the cluster may set fruit, the central flower having the preference. In making crosses I remove all the flowers but one, the best one, and thereby insure success.

5. Why are young trees barren?—It is well known that the blossoms of young and vigorous trees seldom perfect fruit. The reason of this failure has been sought in various directions. It is sometimes stated that the pistils are imperfect, sometimes that the anthers are not developed and that pollen is therefore deficient. So far as opportunity offered, observations were made to determine these points.

A Transparent crab, a year old and standing in a nursery row, produced flowers with abortive anthers. In all other cases which came under my notice, the flowers were perfect. Sometimes the flowers set fruits which grew for several days after the falling of the flower. This was conspicuously the case in a Montreal Beauty crab which had been grafted last year on the wild choke-berry (*Pyrus arbutifolia*), in a young tree of Elton cherry, and in one of *Prunus Simoni*. In general, it is evident that the failure to set fruit is not so much due to an imperfection in the flower as to the great vigor of the young tree. It is well known that over-vigorous trees of any age do not bear liberally. "Checking growth induces fruitfulness." The energy of the plant is consumed so much in the growth of wood that fruit production suffers. For the same reason, no doubt, the early varieties of potatoes do not set so many seed-balls as the late varieties, the vital energy being earlier diverted into the production of tubers. In the same manner, also, can be explained the comparative failure to produce seeds in those plants which produce very vigorous stolons, rhizomes, or other means of propagation.

6. Germination of seeds which have been kept on ice.—Seeds from plants which have been grown for some years in a cold climate often germinate relatively earlier in spring than those from the same species grown in a warmer climate. It is supposed by some that the reason of this quicker germination, or more properly, this greater sensitiveness to heat and other influences of spring, is in some way connected with the freezing of the seed. In other words, it is maintained that the subjecting of the seed to a low temperature causes it to germinate at a lower temperature than one which has not been so treated; or that, at the same temperature, the seed which has been kept uniformly cold will germinate sooner than the other. The same appears to be true of plants as well. "Professor Simpson and Mr. Stewart, of Scotland, acting upon this suggestion, kept alpine seeds and plants in an ice-house during winter; and these, when placed in the open ground, grew more rapidly than those kept in the usual way."*

Two years ago, various seeds were kept on ice during the winter and duplicate sets were kept in a warm room. Both lots were sown the following spring, but for some unaccountable reason very few seeds of either lot grew. Last March a similar experiment was placed in the hands of one of my students, J. C. Duffey of the class of 1887. Seeds of lettuce, Brussels sprouts, radish, cucumber, and parsnip were used, one lot of each being kept on ice two months, the other lot being kept in a warm room. Early in May the seeds were sown in florist's earth, and the results noted for several days. In general, the seeds kept on ice appeared to germinate sooner than the others, but the results were discordant and not strongly marked. We hope to repeat the trial upon a larger scale.

7. Growth of plants from soaked seeds which have been dried.

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*Crozier, Modification of Plants by Climate, 22.

—It has been stated that seeds which have been soaked in water a few hours and then dried give earlier plants than those which have not received treatment. Acting upon this report, a lot of radish and lettuce seeds were put in water August 2. After sixteen hours the seeds were dried in the sun six hours, and then sown in a cold frame, other seeds from the same packets which had not been treated being sown alongside at the same time. At six P. M. August 5, both lots of radish were well up, but the plants from soaked seeds were larger. At the same time the lettuce from the soaked seeds was up, while that from the other seeds was but slightly up at seven o'clock the next morning, August 6. But although the plants from soaked seeds were ahead at the start, they did not maintain their advantage. There was no difference whatever in the time of maturing of the lots of either vegetable. The lettuce was pricked out into a spent hot bed some forty feet in length, filling it compactly, but there was perfect uniformity in the ripening of both lots.

8. WHAT DO WE GET IN LAWN GRASS SEED?—The so-called lawn grass mixtures, sold at exorbitant prices, are not to be relied upon. Often the selection of grasses contained in them is not desirable, and they are especially liable to contain the seeds of weeds. The following weeds came from a sowing of one of these fancy mixtures: Ox-eye daisy, two foreign species of chess (Bromus mollis and B. asper), awned plantatin (Plantago Patagonica var. aristata), Hypochœris radicata, May-weed, spurrey (Spergularia arvensis), Agrostis spica-venti, perennial rye grass, and other valueless grasses. Many common weeds came up in the lawn, which was supposed to be clean ground, and a part of them, at least, were probably sown with the grass seed. My advice to those who contemplate making lawns is to buy pure June grass seed, and to sow it very early in spring—in March or early April or in the fall. June grass seed can be procured of seed dealers for about $1.25 per bushel. The fancy mixtures cost four and five dollars per bushel, and are not so good as the June grass. Do not sow grain of any sort with the June grass. Prepare the soil thoroughly, fertilize it well if it is not strong, and sow the seed at the rate of two or three bushels per acre. If the seed is sown thus thickly the grass will soon cover the surface and choke out weeds, and a multitude of small stalks will be produced instead of a few large ones.

9. TREES AS SHRUBS.—Many trees may be cut off near the ground after they have obtained a good start, when they will throw up a mass of vigorous shoots which answer all the purposes of shrubs. In this manner one may add greatly to the variety and attractiveness of his shrubbery, if the practice is not carried too far. Such clumps always present a novel appearance. They are vigorous, clean, shapely. The sprouts may be cut back nearly to the ground every two or three years, allowing new ones to spring up, thus maintaining the desired size of growth. Most of our rapid growing forest trees are excellent for this purpose upon large lawns. We have good specimens of white ash, basswood, the European field maple (*Acer campestre*), and others, grown in this way. The principle can also be applied to the growing of coppices upon large grounds, or about borders. For such purposes the beech and the oaks are preferable.

Many trees and shrubs are more attractive when grown in this way than when allowed to assume their ordinary forms. Examples of such are the ailanthus and the sumacs. The ordinary wild, smooth sumac (*Rhus glabra*) is one of the finest of decorative shrubs when grown in this manner.

Some of the tender exotics, also, may be managed in this way, especially such as make strong growths and bear large or conspicuous leaves. The paulownia and some of the magnolias may be cited as examples. Such plants should be given rich soil and good culture to enable them to make a long growth.

10. EFFECTS OF LAST WINTER.—The last winter was not severe, although, for the most part, it was one of steady cold, especially after the opening of the year. One week alone was severe. The lowest temperatures of this week were as follows: January 7, 26° below zero; 8, 24° below; 9, 1° below; 10th, 5° below; 11th, 11° below; 12th, 10° below. Injuries to plants were not great. It is such ordinary winters which give the constitution of plants a good and fair trial, however. If a plant cannot endure such winters, it is unfit for open culture here. I append a few notes upon the condition of sundry plants as they appeared in May, when the winter effects can be unmistakably seen. All the plants here recorded were in prime condition when winter set in, except when otherwise stated. They all grew upon thoroughly drained soil.

Fruit Plants.—Quinces of all sorts, both young and old, on both loam and clay, were killed to the snow. This occurs here nearly every winter.

Morus nigra, black mulberry, on sand, killed back to the snow.

Morus alba, white mulberry, on sand, killed back a foot on twigs.

Spanish chestnut killed to the ground. Japanese chestnut the same.

Native plums usually stand well. Some of the pure Chickasaws are too tender, however. Among such, which were killed to the snow, were Robinson, Caddo Chief, Early Red and Lone Star. The two latter were from Texas, two trees of each. Among those injured were De Caradeuc, Hattie and Marianna. The Marianna was injured but slightly on the tips, however. It stood the previous winter remarkably well. It appears to be practically hardy. Among the uninjured native plums are Wild Goose, Minnetonka, Parsons, Forest Garden, Miner, Rollingstone, Itaska, Wolf, Quaker, Wazata, Yosemite, Clinton, Indiana Red, Golden Beauty from Texas, the anomalous Blackman and others.

Russian apricots behaved singularly. Those on peach stood well except in one wet place, while seedlings of the same age were much injured. The same phenomenon occurred last year.

Seedling yearling peach trees were killed to the snow. Two-year seedlings were little injured.

Diamyo, Madam von Siebold and Mikado pears were completely killed; they were injured by the previous winter. Cocklin was killed, one good tree set last spring. Kieffer, on depressed but perfectly drained land, was killed outright. Two others, older, on higher land, have passed several winters without injury. Comet, Le Conte, Sha Lea and Suet Lea were also entirely killed. Birket was little if any injured. Duchesse Hybrid, alongside the others, was not injured.

Nearly all raspberries and blackberries came through the winter in good condition. Of vigorous plants of these two fruits, Cuthbert raspberries were the most injured. Good canes were killed back half their lengths; the canes were very vigorous, however. Turner raspberry canes were nearly destroyed by the winter, but the chief difficulty lay in the weakening effect of last summer's drouth, which severely pinched the plants as they were maturing their last pickings of berries. In a low place, where the drouth was less severe, the bushes did not suffer so much from the winter.

Ornamental Plants.—As usual, *Deutzia gracilis, D. crenata* and *Tamarix gallica* were killed to the ground.

The European elder with variegated leaves, *Sambucus nigra*, in an exposed place, was killed to the ground.

Lonicera fragrantissima is practically hardy; so is the garden variety *grandiflora* of *Hydrangea hortensis.*

The varieties of *Rhododendron Catawbiense* stand well if given some protection from the winter and spring suns. A group planted on the north side of a few deciduous trees has passed two hard winters without injury. They are now (May 30) attractive with blossoms.

Japanese quince is not hardy.

A year ago, young trees of the purple plum, *Prunus Pissardi*, were killed to the snow. Last winter they were slightly injured, except two or three which were top-grafted on *Prunus Americana*, which were destroyed entirely.

Pyrus hybrida and *P. domestica* are hardy and attractive. The latter is one of the handsomest ornamental-fruited plants that we grow.

11. "WATERPROOF FIBRE" CLOTH FOR COLD-FRAMES.—We used last spring a good number of sashes covered with the waterproof fibre cloth manufactured by the United States Waterproofing Fibre Co. of New York. These sashes were used instead of glass sashes for the very late hot-beds and the cold-frames. They gave perfect satisfaction, and present several points of superiority over glass. They are much cheaper, lighter and easier to handle, not liable to breakage, and the plants do not scald under them so quickly as under glass. There are three grades of this cloth, selling respectively for three, six, and nine cents a yard. We tried each grade, but found that the medium grade was far the most useful. The cloth for a frame, therefore, cost us twelve cents, in most cases. The frame itself was made of seven-eighths clear stuff ripped into two-inch strips, halved together at the corners, and each corner was held with an iron corner, such as can be procured at hardware stores for ten cents a pound, or a little less than a cent apiece.

Respectfully submitted,

L. H. BAILEY,
Professor of Horticulture and
Landscape Gardening.

Nov. 5, 1887.

DONATIONS TO THE DEPARTMENT OF HORTICULTURE AND LANDSCAPE GARDENING FOR THE YEAR ENDING JUNE 30, 1887.

E. Eicholtz, Detroit, Kansas:
Scions of Coreless Pear.
L. H. Bailey, South Haven, Mich.:
Scions of various apples.
Geo. W. Parks, Lansing, Mich.:
Scions of Limber Twig apple.

Chas. Alford, Tallmadge, Mich.:
Scions of Dyer, Fall Orange and Herfordshire Pearmain apples.

C. M. Hobbs, Bridgeport, Indiana:
Scions of Indiana Favorite, American Summer Pearmain, White Winter Pearmain.

J. J. Towle, So. Carthage, Me.:
Scions of McLellan apple.

F. M. Ramsey, Bluffton, Llano Co., Texas:
Roots of "wild peach," Diospyros Texana, Berberis trifoliata, Morus microphylla, cuttings of Vitis monticola, "wild peach" and seeds of Vitis monticola.

N. York Experiment Station, per E. S. Goff, Geneva, N. Y.:
Seeds of the "Station" Tomato.

Jenkins, McGuire & Co., Baltimore, Md.:
Sample "Ripe Fruit Carrier."

J. M. Thorburn & Co., N. Y.:
Copies of old seed catalogues.

C. H. Bennett, Jackson, Mich.:
Photograph of a curious turnip.

N. S. Storrs, Springdale, Ark.:
Roots of huckleberries.

Walter Deane, Cambridge, Mass.:
Pits of Prunus maritima.

Prof. T. V. Munson. Denison, Texas:
Seeds of numerous choice species and hybrids of grapes, and other fruits.

Prof. S. M. Tracy, Columbia, Mo.:
Seeds of Opuntia Rafinesquii.

F. L. Piers, New Providence, Ind:
Scions of Piers apple.

H. E. Van Deman, Washington, D. C.:
Plants of Dwarf Service Berry, Amelanchier oblongifolia.

F. L. Wright, Plainfield, Mich.:
Plants of Lucretia, Lucretia's Sister and Bartell Dewberries, seedling strawberries and raspberries, and Jewell grape.

R. Mann, Lansing, Mich.:
Roots of Prunus maritima.

F. A. Dickson & Sons, Chester, England:
Seeds of onions and tomatoes.

F. N. Slacy, Minneapolis, Minn.:
Seeds of blueberry and cranberry, from the northern boundary of Minnesota.

Prof. J. L. Budd, Ames, Iowa:
Seeds of wild olive, Elaeagnus angustifolia.

T. D. Hatfield, Passaic, N. J.:
Tomato seeds.

Mrs. L. G. Carpenter, Agricultural College, Mich.:
Arkansas peas.

Francis Brill, Hampstead, L. I.:
Seeds of cabbages and cauliflowers.

Hon. T. T. Lyon, South Haven, Mich.:
Various scions.

W. Atlee Burpee & Co., Philadelphia:
Various vegetable seeds.
D. M. Ferry & Co., Detroit:
Seeds of Dwarf Sugar Edible Pod Pea.
N. York Experiment Station, through E. S. Goff:
Tubers of Solanum Maglia and S. Jamesii.
J. D. Likely, Jefferson, Mich.:
Scions of the Likely apple.
J. R. Johnson, Dallas, Texas:
Plants of Never Fail Fig, Dallas Blackberry and Hendricks Almond.
John Wragg, Waukee, Iowa:
Scions of Haskel Sweet, London Sweet and Saxton apples, and Wragg cherry trees.
S. Gordon, Sergeantsville, N. Jersey:
Scions of many new and choice varieties of apples.
Peter M. Gideon, Excelsior, Minnesota:
Scions of twenty varieties of hardy apples.
Forestry Division, U. S. Department of Agriculture, by B. E. Fernow:
Seeds of Nordmann's Fir, Siberian Larch, and Siberian Fir, (Abies Nordmanniana, Larix Sibirica *Ledb.*, Abies Sibirica *Ledb.*)
A. W. Livingston's Sons, Columbus, Ohio:
Various vegetable seeds.
J. B. Root & Co., Rockford, Illinois:
Various vegetable and flower seeds.
James B. Wild & Bros, Sarcoxie, Missouri:
Three Chinese Cling Peach Trees.
Hon. H. C. Sherwood, Watervliet, Mich.:
Scions of Mother Apple.
John N. Evans, Lewiston, Idaho:
Scions of Idaho Pear and a seedling apple.
J. G. Ramsdell, South Haven, Mich.:
Scions of Yellow Newtown Pippin and Jefferis Apples.
Dr. C. E. Davison, Wayland, Mich.:
Plants of a new black raspberry.
C. F. Leipprandt, Hayes, Mich.:
Scions of German Prune and three seedling apples.
Hamor, Kunz, Roscoe & Co., Du Bois, Penn.:
Three Boyer's Medicated Plant Protectors.
F. R. Palmer, Mansfield, Ohio:
Plants of Palmer raspberry.
T. H. Hoskins, M. D., Newport, Vermont:
Scions of various Russian apples.
Chas. Mohr, Mobile, Ala.:
Seeds of Cratægus brachyacantha, C. berberifolia, C. æstivis.
Matthew Crawford, Cuyahoga Falls, Ohio:
Plants of Crawford and Ada strawberries.
Thomas Wilde, Coopersville, Mich.:
Plants of Gothic strawberry.
R. Johnson, Shortsville, N. Y.:
Plants of Johnston's Sweet Black-cap, Ontario strawberry and Erie blackberry.

E. Mosher, Holly, Mich.:
Scions of a new apple.
D. B. Harrington, Mason, Mich.:
Tubers of various potatoes.
J. J. Wolfenden, New Borne, N. C.:
Cowpeas, "Improved Whipporwill."
F. E. Wood, Hancock, Mich.:
Three species of huckleberries.
Thos. Morong, Ashland, Mass.:
Plants of Fragaria Virginiana.
A. Commons. Faulkland, Del.:
Plants of Fragaria Virginiana.
Baron Ferd. von Mueller, Melbourne, Australia:
Seeds of Anabasis Ammodendron. Pittosporum undulatum, Albizzia Saman, Acacia decurrens, and various grasses from the Darling desert.
L. F. Henderson, Portland, Oregon:
Plants of wild strawberry.
P. J. Berckmans, Augusta, Ga.:
Fruits of Peen-to peach.

L. H. BAILEY,
Superintendent.

AGRICULTURAL COLLEGE BULLETINS.

No. 22.—VETERINARY DEPARTMENT.

OBSERVATIONS ON A DISEASE AFFECTING THE EYES OF SHEEP.

During the summer and autumn of last year, my attention was called to a disorder among sheep, which affects their eyes in such a manner, that it will sometimes leave them blind in one or both organs; fortunately, though, the disease yields to treatment in the majority of instances, not, however, before going through a stage of very acute inflammation, causing much inconvenience, and suffering to the afflicted animal.

THE DISEASE,

as I have had occasion to observe it, breaks out in a flock, attacking one animal after another, in such a manner, as would naturally give one the impression, that it is of a contagious nature. At the same time, a very large proportion which are exposed, seem to be armed with that peculiar weapon, "immunity," which renders them proof against an invasion.

In comparing my observations of the complaint, with descriptions of the diseases of sheep, by various authors, I was struck with one account, by a well known writer upon veterinary topics (Youatt), who, writing in the early part of the present century, and quoting, in substance, an old shepherd says: "That sheep, when wandering over the moors, will sometimes accidentally tread upon a lark's nest; that the old bird, becoming alarmed as to the safety of her offspring, will rise up, like a game chicken, and spur the intruder in the eyes, and it (the sheep) is then said to be 'lark-spurred.'"

From the above it can be imagined how popular the term, "lark-spur" would become among attendants upon sheep; besides, it was an easy way of accounting for the appearance of the malady. Under the circumstances, the disease was frequently left to run its course, and, as a result, cataract, with total blindness, was a common termination. So common has the term "lark-spur" become in some countries, that it is applied to nearly all diseases affecting the eyes of sheep, by certain people.

IN NAMING THE DISEASE,

I think the most appropriate term which can be applied to it, is "Enzöotic Opthalmia;" for, like other enzöotic diseases, it attacks a number of animals in a certain locality, or it may be confined to a single farm, while the term opthalmia, is now universally applied to certain diseases of the eye, both in human and veterinary medicine.

THE CAUSE OF THIS DISEASE,

like the cause of many similar enzöotics, is still wrapped in deep obscurity. I need hardly say that I do not believe in the lark-spur theory. Then there are those who say it is the result of fatigue, from over-driving upon dusty roads for instance, or exposure to cold, after shearing, or, indeed, at any time, and that sudden changes of the weather are liable to bring on an attack. Although it may be true that any debilitating influence, such as exposure, etc., is liable to render an individual more susceptible to the complaint, yet I cannot think that that alone will produce it. Indeed, it seems to have no respect for the condition of the animal, breed, or sex, age or size, or other circumstance that I can suggest, unless I take advantage of that now fashionable way of accounting for the existence of certain maladies, and condemn it as a "malarial trouble;" for it is not at all improbable that a specific virus floating in the air, and finding a suitable habitat in some sheep, will perform its various eccentricities.

SYMPTOMS.

The complaint is easily recognized, as several animals in a flock will become suddenly blind, without any apparent cause. Taking a casual look at the malady, one cannot help being impressed with the similarity between this disease and Pinkeye in horses; but closer observation will show with tolerable certainty that they are two distinct disorders.

On watching the course of enzöotic opthalmia in sheep, from day to day, we will find, first of all, that the ball of the eye, instead of presenting that bright, glistening appearance, characteristic of it, will be dull or opaque looking, the eyelids will be inflamed, and the animal will not be able to tolerate light, but be constantly blinking; tears will flow profusely over the cheek, and there will be more or less discharge (of tears) from the nose. In the course of a day or two, the eyes will appear redder and larger, which condition will often be accompanied with, or followed by angry looking sores. These are seen, sometimes, to eat their way through the eye-ball, and allow the internal structure of the eye to escape: that is, the fluid portion; when the internal structures become involved, a cataract and permanent blindness is liable to be the result.

This ulceration never occurs in Pinkeye in horses, that I am aware of, nor does it in mild cases in the sheep.

The constitutional symptoms, like the local, vary considerably with the individual. In some I have found but slight fever, while the clinical thermometer would indicate considerable elevation of temperature in the next one examined—ranging from 102° to 105° Fahr. Some animals lose their appetite while others eat tolerably well, the bowels become more or less constipated, unlike pinkeye, is there that disturbed condition of the alimentary canal so often noticed in the horse. Nor does there appear to be the same tendency for sheep to abort, as there invariably is with the mare in the latter half of pregnancy.

While the constitutional symptoms of pinkeye appear to be much severer in the horse, than the constitutional symptoms of the disease resembling it in sheep, yet the opposite is the case with regard to the local symptoms.

THE TREATMENT

of this disease should be both local and constitutional, and the surroundings of the animal should also be properly considered.

The affected sheep should be placed by themselves, in a comfortable, dry shed, well aired, darkened to prevent unnecessary irritation from sunlight. The eyes should be thoroughly fomented with warm water every day, until the acute symptoms subside, or say for about four days. After fomenting I have found great benefit from the application of a weak solution of nitrate of silver, say about five grains to the ounce of pure rain, or distilled water. If the eye is ulcerated, touch the ragged sores with the pure lunar caustic occasionally. In applying fluids to the eyes, a few drops may be shaken from the end of a small vial, or a common quill run through the cork, makes a convenient way of putting in the medicine. I have also used a camel hair brush or soft feather; either will answer very well. Of course the attendant will require an assistant to hold the sheep, while the medicine is being applied.

The constitutional treatment may be directed, first of all, to the bowels, and if they are not operating regularly, a saline purgative should be given, say Epsom salts, four ounces dissolved in half a pint of hot water and allowed to cool. About forty-eight hours after the purgative has done its work, should the inflammation still remain in the eyes, diuretics may be given. Among others, I have found relief following the administration of nitrate of potash when prescribed as follows: Take three drachms of nitrate of potash, and dissolve it in eight ounces of water. One ounce of the mixture to be given morning and evening. If at the end of a week from the time of the first dose, the inflammation has not entirely subsided, the diuretic may be repeated.

During the treatment, the sheep should be fed upon laxative diet, such as roots, bran mash, linseed, and the like.

E. A. A. GRANGE,
Professor of Veterinary Science.

January 1, 1887.

No. 23.—DEPARTMENT OF HORTICULTURE AND LANDSCAPE GARDENING.

VARIETIES OF APPLES FOR MARKET.

An important reason why apple culture does not oftener return a profit is the careless manner in which varieties are usually selected. No amount of good culture or shrewd marketing can make poor varieties profitable. The selection of varieties is often a difficult task to those inexperienced in orchard culture, both from the great number of varieties from which to choose, and from the fact that the same variety does not thrive equally well in different places. The first difficulty is easily evaded, as out of some thousand varieties in cultivation not more than twenty-five usually prove to be profitable in any locality, and even of this number there are seldom more than five or six which can be confidently recommended. The second difficulty must be overcome by a close attention to the apples which succeed best in the vicinity. The three most important points in a market apple are these: A hardy, vigorous tree; a good bearer; a large, red fruit. Unfortunately, there are very few apples which combine these features in Michigan. In general, we are fortunate if we secure two of them in one variety.

Agents have been canvassing the State for the last two months, and many sales of worthless varieties have been made. The blame is not always, if, indeed, it is usually, the agent's. Too many buyers are in condition to be imposed upon. Very often the agent sells in good faith trees which are valueless for the locality in which they are sold. It is to check such sales or to enable purchasers to make intelligent substitutions in their purchases that this bulletin is issued.

Until the last few years the Baldwin has held the first place among market apples. The increased severity of the winters, resulting from the destruction of timber, has caused the Baldwin to suffer above most other popular varieties. During the winter of 1884–5 fifty old trees were killed in the College orchard, of which over forty were Baldwins, the remainder being mostly Rhode Island Greenings. In fact, there is not a vigorous tree of these varieties left in the orchard. All others among the market sorts were not injured. It is more and more evident that the Golden Russet is one of the best market apples for this region. The tree is remarkably hardy and vigorous and a good bearer. The apples are uniform in size and color, very firm, fair, and good keepers. In market they bring twenty per cent. less than Baldwins, but this difference is overbalanced by their productiveness and hardiness. Russets should be barreled in the fall to prevent withering. The Spy is a tardy and unreliable bearer; the apples are often very imperfect, and they are too tender for distant markets. I should not recommend it here for the flatter lands. Fameuse is one of the best when the fruit is fair, but it is unreliable. Canada Red, top-grafted, is one of the very best, and in this vicinity undoubtedly ranks next to the Russet, or perhaps superior to it. The St. Lawrence, Oldenburgh and Twenty Ounce appear to be among the best fall apples for this vicinity. The Oldenburgh demands a close market, however, as it decays soon. The Russian apples of recent introduction are not yet sufficiently known to be recommended for profit.

The reports of our State Horticultural Society contain many lists of apples, and they should be consulted before an orchard is planted. As further aids I add recent communications from leading orchardists. It is high time that everyone take aggressive action in regard to this matter of varieties of apples. The success of our apple culture demands it. In general, purchasers should beware of novelties and high prices. The standard kinds can be had for from $10 to $18 by the hundred for two-year-old trees. It is probable that the following choices contain all the sorts generally valuable in Southern Michigan. These choices, of the best five varieties, are made in reference to hardiness:

From Hon. Henry Chamberlain, Three Oaks, Berrien County.—I should select for our vicinity, Baldwin, Canada Red, Northern Spy, Maiden's Blush, and Stark. The Golden Russet has never proved satisfactory with us.

From Wm. A. Brown, Benton Harbor, Berrien County.—The question of five apples for profit depends much upon location, facilities for marketing, adaptability, etc. The location of Berrien county enables us to grow and market the early varieties more successfully than later and more isolated locations. Without giving the subject the fullest consideration, I should name Oldenburgh, Orange Pippin, Brown Pippin, Hubbardston, Baldwin, Ben Davis. In naming the list I am governed more by productiveness and resistance to fungous blight than by quality of the apple. In fact, I have named but one good dessert apple, the Hubbardston. The Orange Pippin is not generally known. Brown Pippin is the local name of a fine, large red apple ripening in September. This name may be a synonym, but we have not been able to determine it yet.

From Geo. W. Lawton, Lawton, Van Buren County.—I should select Northern Spy, Baldwin, Red Astrachan, Canada Red, Henrick's Sweet,—all red apples, which sell better than any other. They are also of such size as to be acceptable for table use. Of course this is not the limit of valuable apples raised here.

From President T. T. Lyon, South Haven, Van Buren County.—I doubt the relative profitableness of the summer and autumn apples, and therefore will name Baldwin, Northern Spy, Rhode Island Greening, Golden Russet and Stark. Baldwin is hardy enough with us. If omitted for lack of hardiness, I should add Hubbardston at the foot of the list.

From L. H. Bailey, South Haven, Van Buren County.—Baldwin, Stark, Northern Spy, Ben Davis, Flushing Spitzenburg. There are several profitable fall varieties, of which the Oldenburgh is probably the best. The Mann, much recommended of late, grows well and bears well, but is the wormiest of all my apples. The color is also bad. I have grafted most of mine to Baldwin and Flushing Spitzenburg.

From James F. Taylor, Douglas, Allegan County.—I will speak only of varieties which I have in bearing, as follows: Baldwin, Rhode Island Greening, Talman Sweet, Maiden's Blush, Red Astrachan. The Baldwin tree is not entirely hardy in some localities, but near the lake, as I am, it never winterkills.

From B. Hathaway, Little Prairie Ronde, Cass County.—The Northern Spy, the Red Canada and the Baldwin are the three kinds that I should name, and in this order. Most men would place the Baldwin first, and I should if it were hardy in tree; but it is not. It is liable to fail anywhere, and sure to fail on our strong lands so far south as this. Properly grown, and planted on suitable soil, it is probably the most profitable apple we yet have. The fourth in the list as it seems to me (and it would be first if as good a keeper as the others), is the Hubbardston [Nonesuch]. This, for evaporating purposes, is one of the best, as it is a profuse, constant bearer on strong land, always fair, and ripe enough in the fall to make nice fruit, and is uniform in size, of good shape and quality. The fifth sort I cannot so well name. If I put in a fall apple it would be the Maiden's Blush,—not a good apple, but good to sell and to evaporate.

From Graham Bros., Grand Rapids.—We would give these as our choices of the best five market apples for this place: Northern Spy, Baldwin, Oldenburgh, Rhode Island Greening, Thompkin's King.

From J. N. Stearns, Kalamazoo.—My choice for best five apples for profit would be Baldwin, Hubbardston, Maiden's Blush, Oldenburgh, and Wagener if not allowed to bear until seven or eight years old. I place Baldwin first; although not so hardy as some, I consider it the most profitable by far.

From H. Dale Adams, Galesburg, Kalamazoo County.—For summer and fall: first, Oldenburgh; second, Red Astrachan. For winter or very late fall: first, Baldwin; second, Northern Spy; third, Fameuse *on heavy soil;* fourth, Twenty Ounce. No others come within the limits of profit in this vicinity.

From Geo. W. Parks, Lansing.—The Baldwin stands first in my estimation, save the tenderness of the tree. On high, rolling lands with clay subsoil it appears to stand up very well, but on low, flat land it does not endure our severe winters. I would make my list as follows: Baldwin, Canada Red, Limber Twig, Northern Spy, American Golden Russet.

From James Satterlee, for Greenville, Montcalm County.—Northern Spy, Golden Russet, Red Canada, Jonathan, Red Astrachan, Twenty Ounce. The Spy does best on the lighter soils.

From H. W. Davis, Lapeer Evaporating Works, Lapeer.—Red Canada will bring 25 cents per barrel more than any other variety we grow. Baldwin, Northern Spy, most any other fair red variety, and Rhode Island Greening are to be recommended. The Red Canada is always hardy. Baldwin was hurt some two years since, but not enough to speak of. Northern Spy and Greenings are iron-clads, so to speak. These are old varieties to be sure, but they bring in the dollars.

From Hon. N. A. Beecher, Flushing, Genesee County.—Our best hardy market apples may be named in the following order: Golden Russet, Ben Davis, Northern Spy, Red Canada and Talman Sweet for winter; Lyscom, Oldenburgh and St. Lawrence for fall.

From Porter Beal, Rollin, Lenawee County.—My choice of five varieties is as follows in order of preference: Baldwin, Ben Davis, Golden Russet, Willow Twig, Red Canada.

From Hon. George Oviatt, Chase, Lake County.—Ben Davis, Wagener, Golden Russet, Oldenburgh for a near market. The Baldwin is injured by the winters.

From Hon. Arthur T. Case, Benzonia, Benzie County.—Among our hardy apples the following are the best and in about the order named: Westfield (Seek-no-further), Northern Spy, Golden Russet, Fameuse, Talman Sweet, Swaar, Haas. Baldwin, Wagener, and Ben Davis do not stand the climate, unless it is on the higher land immediately along the lake.

The college is ready to make a trial of any fruits, and to distribute, as far as able, scions or buds of the new or promising kinds. Over two hundred varieties of apples are now being grown, including the Russians. A partial list of these and other fruits is printed in the Report of the State Board of Agriculture for 1885, pp. 136 and 163. Most of these apples are not yet bearing.

L. H. BAILEY, Jr.,
Professor of Horticulture
and Landscape Gardening.

Agricultural College, Michigan,
February 1, 1887.

No. 24.—DEPARTMENT OF PRACTICAL AGRICULTURE.

FEEDING STEERS OF DIFFERENT BREEDS.

For some years it has seemed to the writer that the feeding of good specimens of the different breeds of cattle from calfhood to maturity, under the same conditions, except amount of food, would be a desirable experiment.

A careful record of all food consumed, the comparative data as to kind and quality of food, growth, time of maturing, gain for food consumed, etc., would be of permanent value.

Breeders may make fair or extravagant claims for their favorites; but too often the claim has little foundation, more than "I guess so." Actual, positive knowledge of breeds is what we want.

Not that one test of this sort would demonstrate beyond question the feeding qualities of the different breeds; but it would be a first step in the right direction and would prove an instructive object lesson of the habits and capacities of growth of the different animals during the continuance of the trial.

This would be especially true at our own college, where great stress is laid on the study of the breeds and the best specimens are procured as aids in illustrating the subject.

While tests have been made by feeding animals of different breeds for a brief period, together—the fact that they have been cared for in different ways for the first year or two, before coming together under like conditions, has greatly lessened the accuracy of any practical results obtained.

I am not aware of any similar test ever having been made, viz.: the feeding of representative specimens of six pure breeds, brought together at weaning-time and cared for under the same conditions; with careful record of the breeding and history of each, the food consumed, its weight and make-up, and such other items as have seemed of value.

It has seemed to me that two animals of each breed would be better than a larger number for a test of this sort. They should have comfortable quarters, conveniences for stabling, pasture, water, storage of feed, weighing facilities, and the most prompt and regular attendance. The work ought to be done by one and the same man. With a larger number this would be more difficult.

It is true that a larger number might give more opportunity to eliminate some elements of uncertainty; but it is a question whether they would not introduce more, and confuse results rather than make them more accurate.

Three years ago I called the attention of the Board of Agriculture to the importance of this subject. It met with their approval, but there were no funds with which to procure the animals. Two years ago the Legislature made an appropriation for this special purpose. It was hoped that the breeders of the State, many of whom had expressed themselves in favor of the trial, would furnish such specimens of the breeds as they thought would best uphold the claims of their favorites.

At our spring sale in March, 1885, Mr. H. H. Hinds, President of the Michigan Shorthorn Breeders' Association, who has always manifested a cordial interest in all our work, presented this matter to the State Board of Agriculture, and thought that the different Breeders' Associations would be glad to donate the calves, selecting such as they believed would be likely to make the best showing for the respective breeds. Mr. Robert Gibbons, editor of the Michigan Farmer, was present, and I herewith append his report of the remarks of Mr. Hinds, and the resolutions adopted by the Board.

TESTING THE BREEDS.

"At the stock sale at the Agricultural College last week, all the members of the State Board of Agriculture being present, Mr. H. H. Hinds, President of the State Shorthorn Breeders' Association, after a few words of explanation, made the offer that if the Board would select one or two select specimens of each of the beef breeds, of about the same age, giving them equal care and attention, and keeping a full record of the feed consumed and the gain made by each, he, on behalf of the Shorthorn breeders, would offer such selected animals free of expense, to the college. He said he did this without consultation with his brother breeders, but he knew they would stand by him. He wanted to see the breeds tested fairly, and each represented by animals selected by the friends of the breeds to represent it. He would also like to see some good native steers, free from any admixture of thoroughbred blood, fed with the others, so as to bring out the true merits of each. These animals could then be exhibited at the State and other fairs, and farmers could draw their own conclusions. The college was in shape, since its experimental barn was built, to conduct such an experiment, with the carefulness and attention to details it should have, and he hoped breeders of each of the beef breeds would take an interest in such a test.

"The members of the Board, after some discussion among themselves, in which all spoke favorably of the proposition, unanimously adopted the following preamble and resolutions:

"WHEREAS, The Michigan Shorthorn Breeders' Association, through its President, has volunteered to select and furnish two specimens of Shorthorn calves for the purpose of testing their relative feeding qualities compared with other breeds; therefore

"*Resolved*, That the Michigan State Board of Agriculture accept the proposition and respectfully solicit other associations or owners of other breeds to select two specimen calves of each of the several breeds for the purpose of making a careful test at the Agricultural College of their relative merits for fattening purposes. Correspondence in relation to the test should be addressed to Prof. Samuel Johnson, Agricultural College, who will furnish information in regard to it.

"Now, let the Hereford, Polled Angus, Galloway, and Devon breeders be heard from, and we shall have a test of the merits of each of the great families of thoroughbreds that will demonstrate their high merit and the value of each to the farmer. It will be a liberal education in feeding to have such a test thorougly made."

After waiting until Nov., '85, and not receiving any calves, I reported to the Board of Agriculture as follows:

There is no lack of public spirit among our cattle breeders, many of whom have expressed a desire for such a test; but many feel, and I cannot help sympathizing in the feeling, that the State is abundantly able to purchase the stock needed for its experimental work. The members of our State Board feel in this way and I think, as some six months have elapsed since the adoption of the above resolution and no offers of calves have been made, we had best conclude that if we are to have specimens of the breeds to feed we must buy them for that purpose.

The outlay required will be as much or more perhaps than the animals will bring after three years' care and feeding; but we must not forget that experiments are not remunerative directly in a pecuniary way—only in the lessons gleaned from them and the conclusions they demonstrate.

I therefore recommend that a portion of the amount appropriated for feeding experiments be expended for animals for this purpose, and that they be secured as soon as possible, at the same time holding ourselves in readiness to accept selections made by any of the Breeders' organizations pursuant to the resolution adopted by the Board of Agriculture; provided the animals in these classes have not been previously secured.

In accordance with this recommendation I was instructed to procure as soon as practicable, good specimens of the breeds on reasonable terms. I found more difficulty in procuring the animals than I had anticipated. It will be noticed that four of the animals in the test were bred at the College.

All of the gentlemen furnishing steers have been liberal in pricing their animals for this purpose.

I think the selections are of such character and quality as will merit the approval of the advocates of each breed represented.

The steers have been kept when in barn in roomy box-stalls, well supplied with bedding. During the hot weather they were stabled during the day and allowed to run on short pasture at night. When the weather became cooler the order was reversed, and they were stabled at night and in pasture in day time.

FOOD.

The grain ration up to January 10, was composed of equal parts by weight of wheat bran, oats whole or ground, and old process oil meal. From January 10, we substituted corn and oats ground (in the proportion of two-thirds corn and one-third oats) for the clear oats.

The hay has been clover and timothy of good quality. All of the hay has been cut before feeding. The ensilage was corn. They have been fed and watered regularly three times daily, and usually groomed; have had daily exercise.

On the following pages will be found a history of the animals, and a table giving the daily grain and hay ration, the total food consumed in each period, the weight at beginning and end of period, and the gain for each month.

HOLSTEIN BELTZ.

Calved November 17, 1885; bred by Seeley & Coleman, Lansing, Michigan; sire, Nicholas 3d, 263 D. F. H. B.; dam, Wiesman's Sjoeratzi, 972. Nicholas 3d weighed 1850 lbs. in breeding condition, at 2½ years old. Beltz weighed at birth 121 lbs.; castrated February 9, 1886.

He was taken from the cow when four days old, fed four quarts new milk night and morning, and three quarts skimmed milk at noon until four weeks old. During second month, two quarts of skimmed milk was fed with two quarts new milk night and morning, and three quarts skimmed milk with two tablespoons oil meal at noon.

The feed during the third month was four quarts skimmed milk and two tablespoons oil meal three times a day.

The feed during the fourth month was five quarts skimmed milk with one-half pound of mixture of five pounds ground oats to one pound oil meal three times per day. During the fifth month the feed was, six quarts skimmed milk twice a day, and four and a half pounds corn meal and oat meal, equal parts, in three feeds. At five months commenced to diminish the milk until five and one-half months old; had no milk after that time; was out on grass night and day, and had four and one-half pounds corn and oat meal in two feeds.

HOLSTEIN STEER NICHOLAS.

Calved February 26, 1886; bred by Michigan Agricultural College, Lansing; sire, Nicholas 3d, 263 D. F. H. B.; dam, Mae, 112 D. F. H. B.; castrated April 22. Nicholas had five pounds of milk from birth to May 20 (twice each day), then 6 pounds to June 20; was then weaned. Fully weaned July 10. Fed oat meal and calf meal a gill to a feed, gradually increasing to ration as given in period 5 in table.

GALLOWAY STEER KING JUMBO.

A. G. H. B. 2786; calved February 17, 1886; bred by R. B. Caruss, St. Johns, Michigan; sire, Sir George Grey 714; dam Rosy No. 510; weight at birth, 60½ lbs. He was taken from the cow and fed new milk. At one month old he took the entire milk of the cow, which was about eight quarts at a milking. ing. Jumbo's weight at one month was 146½ lbs. He was fed as above during the second month, and at the end of two months weighed 219 lbs.; castrated March 30, 1886. During the third month he was fed as above with the addition of 5 pounds of oil meal and 5 pounds of wheat bran during the month. At the end of the third month he weighed 290 pounds. During the fourth month he ran at large in pasture with other calves and had skimmed milk and 8 pounds of oil meal and 50 pounds of bran during the month. At four months weighed 338 lbs.

GALLOWAY STEER JUDGE.

Calved January 1, 1886; bred by J. L. Wicks & Co., Colby, Michigan; sire, Garfield 634; dam, Midnight 651. Judge ran with cow until July 15; had begun feeding him July 1, and July 15 he was taking 2 pounds corn meal and 2 pounds bran at two feeds. From July 15 to August 5, 4 pounds corn meal and 2½ pounds bran. Castrated April 9, 1886; weight April 9, 305 lbs.; weight July 27, 590. Judge was brought to the college farm July 27, '86.

HEREFORD STEER HENDRICKS.

Calved October 27, 1885; bred by Edwin Phelps, Pontiac, Mich.; sire, Waxwork A. H. R. 6320 and E. H. H. B. (6250); dam, Cornelia A. H. R. 10350. Hendricks had the milk of his dam, being kept in a pen with calves of about the same age, and suckled twice a day. He was allowed to eat all the hay he wished, and at eight weeks he began to eat a little meal—equal parts of oats and barley—gradually increasing in amount until at seven months he received two pounds morning, noon and night; was not weaned until sent to the college farm. Hendricks was castrated February 23, '86, at four months;

weight at that time, 350 pounds; weight at 7½ months, 575. June 16, '86, reached college farm.

SHORTHORN STEER HOMER.

Calved November 25, 1885; bred by State Agricultural College, Lansing, Michigan; sire, Col. Acomb 2d, No. 37984, A. H. B.; dam, Hebe 2d; suckled dam—a good milker; castrated December 28, 1885.

February 10 began to eat a little meal and hay with dam. May 3 turned to grass with dam and brought up nights and fed. May 18 was left on grass —not fed meal. June 1 taken from cow and put in the experimental barn; turned to dam night and morning and feed grain daily, two pounds twice a day. June 10, three pounds once a day, and two pounds once a day. June 19, three pounds night and morning to July 23; grain fed was equal parts of bran, oats, and "calf-food;" whole amount consumed to July 23, grain 279 pounds, hay 98 pounds; weaned in July.

SHORTHORN STEER HOLT.

Calved December 17, 1885. Bred by Michigan Agricultural College. Sire, Col. Acomb 2d, No. 37984, A. H. B.; dam, Hela V., a very moderate milker; castrated December 28, 1885; fed with cow up to May 3, 1886; treated exactly like steer Homer.

DEVON STEER LATITUDE.

A. D. R. 3750, calved March 23, 1886; bred by H. W. Calkins, Allegan, Michigan, an in-bred calf; sire, Charles (2014); dam, Snow Bloom (4600); 2d dam, Factory Girl (4596). Snow Bloom (4600) was sired by Charles (2014); castrated July 6, '86. Latitude was taken from dam 3d day and fed new milk for ten days. After he was two weeks old he was fed from three to four quarts of creamery skim-milk twice per day. The milk stood 24 hours before feeding. Latitude reached college by express June 22, 1886. He was donated to the college by Mr. Calkins. Weight June 24, 170 pounds.

JERSEY STEER ROSCOE.

Calved August 27, 1885; bred by Michigan State Agricultural College; sire, Bobby Roscoe No. 10497 A. J. C. C. R.; dam, Idyl of Cedar Vale I., No. 11896 A. J. C. C. R. Roscoe was fed 5 pounds of new milk twice daily, gradually decreasing until January 7, '86, when he was fully weaned. Fed milk 122 days; amount consumed, 1,259 pounds; was not turned out of stall during first fall. Up to January 20 he had consumed 15 pounds bran, 15 pounds oat meal, 10 pounds oil meal or 40 pounds grain and 5 pounds hay. Jan. 20 began feeding 3 pounds daily of equal parts of bran, stock food and oat meal. Castrated October 13, '85; weight January 20, 252 pounds. February 23 Roscoe consumed daily ration of 3½ pounds hay and 3½ meal as above. Total hay, 165½ pounds; grain, 165½ pounds; weight, 306 pounds. February 23 substituted oil meal old process for the stock food. June 10 was put in experimental barn and fed night and morning and then turned out to pasture.

JERSEY STEER POTTER.

Calved February 25, 1886. Bred by L. B. Potter, Lansing, Michigan. Sire, Saginaw 2d, A. J. C. C. R; dam Louisa Countess, A. J. H. B. Potter was fed a scanty supply of new milk during the first month; then a scanty supply of skim milk, with oil meal added until sent to the college, May 28, 1886. June 5 was castrated, and June 15 turned to grass and fed night and morning eight pounds of milk and one pound oat meal daily.

Months.	Number of period.	Daily Ration.		Total food consumed.	Weights and Gains.		
		Grain.	Hay.		Weight at beginning of period.	Weight at close of period.	Gain.
Holstein Steer.—Beltz.		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
May 28—June 10, 1886	1	2	4	78	500	570	70
July 10	2	2	4	180	570	630	60
August 10	3	7	6	390	630	710	80
September 10	4	7.2	7.2	432	710	746	36
October 10	5	7.25	4.25	345	746	788	42
November 10	6	8.25	11	577	788	860	72
December 10	7	9	10.1	572.75	860	930	70
January 10	8	8.8	12.3	633	930	1,000	70
February 10	9	9	13	660	1,000	1,046	46
March 10	10	9	13	750	1,046	1,080	34
Holstein Steer.—Nicholas.							
			Milk.				
February 26—April 10, 1886	1	----------	10	----------	115	170	55
May 10	2	----------	10	----------	170	210	40
June 10	3	----------	11.33	----------	210	270	60
July 10	4	----------	8	----------	270	310	40
August 10	5	4.25	2.5	202½	310	337	27
September 10	6	5	2.25	217½	337	380	43
October 11	7	5.33	2	220	380	452	72
November 10	8	5.66	7.33	390	452	522	70
December 10	9	6.2	8.9	453	522	572	50
January 10	10	6.6	9.7	489	572	640	68
February 10	11	6	9	450	640	688	48
March 10	12	6.5	10	585	688	760	72
Galloway Steer.—King Jumbo.							
March 17, 1886	1	----------	----------	----------	60.5	146.5	86
			Milk.				
April 17	2	----------	16	496	146.5	219	72.5
			Milk.				
May 17	3	.33+	16	490	219	290	71
June 17	4	1.9	----------	58	290	338	48
July 10	5	4	----------	92	338	384	46
			Hay.				
August 10	6	2.3	2.25	136.5	384	414	30
September 10	7	3.18	4.9	244.5	414	460	46
October 11	8	3.25	3	187.5	460	524	64
November 10	9	4.5	8.25	382	524	572	48
December 10	10	5	9.9	447	572	586	14
January 10	11	6.1	9.5	468.25	586	670	84
February 10	12	6	9	450	670	712	42
March 10	13	6.5	9.5	570	712	746	34

Three pounds ensilage daily, during the period ending March 10.

Months.	Number of period.	Daily Ration.		Total food consumed.	Weights and Gains.		
		Grain.	Hay.		Weight at beginning of period.	Weight at close of period.	Gain.
Galloway Steer.—Judge.		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
April 9-July 27, 1886	1	----------	----------	----------	305	590	----------
August 10	2	5	4.5	133	590	600	10
September 10	3	6.2	6.5	381	600	670	70
October 11	4	6.5	3.5	300	670	722	52
November 10	5	7	11	540	722	793	71
December 10	6	7.5	12.8	609	793	800	7
January 10	7	7.4	14.2	648	800	885	85
February 10	8	7.75	12	592.5	885	920	35
March 10	9	7.75	12	682	920	960	40
Hereford Steer.—Hendricks.							
June 17—July 23, 1886	1	----------	5.5	198	----------	554	----------
August 10	2	4	2.6	119	554	592	38
September 10	3	4	4.25	247	592	620	28
October 11	4	4.5	4.5	270	620	670	50
November 10	5	5.33+	9.5	445	670	736	66
December 10	6	6.1	10.5	498.5	736	760	24
January 10	7	6.5	10.8	519	760	818	58
February 10	8	6	9	450	818	835	17
March 10	9	6.5	10	585	835	874	39
Short Horn Steer.—Homer.							
January 10-February 10, 1886	1	----------	----------	----------	190	270	80
March 10	2	----------	----------	----------	270	320	50
April 10	3	----------	----------	----------	320	385	65
May 10	4	----------	----------	----------	385	440	55
June 10	5	----------	----------	----------	440	540	100
July 10	6	6	----------	180	540	620	80
August 10	7	6	3.21	276	620	690	70
September 10	8	6.6	5.2	354	690	720	30
October 11	9	6.66+	4.7	341	720	792	72
November 10	10	7.16	11.16+	550	792	870	78
December 10	11	7.7	13.2	627	870	888	18
January 10	12	7.9	13.5	642	888	950	62
February 10	13	7.75	12	592,5	950	995	45
March 10	14	8	13	720	995	1,052	57
Short Horn Steer.—Holt.							
January 10-February 10, 1886	1	----------	----------	----------	145	185	40
March 10	2	----------	----------	----------	185	225	40
April 10	3	----------	----------	----------	225	260	35
May 10	4	----------	----------	----------	260	320	60
June 10	5	----------	----------	----------	320	400	80
July 10	6	6	----------	----------	400	480	80
August 10	7	6	2.28	248	480	545	65
September 10	8	6.6	4.15	322	545	585	40
October 11	9	6.33+	3.66+	300	585	622	37
November 10	10	6.87+	9.66+	496	622	706	84
December 10	11	7.4	11.3	561	706	736	30
January 10	12	7.9	11.1	570.5	736	814	78
February 10	13	7.75	12	592.5	814	864	50
March 10	14	8	12	690	864	914	50

Three pounds ensilage daily, during the last period.

Months.	Number of period.	Daily Ration.		Total food consumed.	Weights and Gains.		
		Grain.	Hay.		Weight at beginning of period.	Weight at close of period.	Gain.
Devon Steer.—Latitude.		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
June 24–July 10, 1886					170	178	8
August 10	1	3.03	2.33	161	178	205	27
September 10	2	3	2	155	205	240	35
October 11	3	3.25	1.25	135	240	266	26
November 10	4	3.5	3.5	210	266	310	44
December 10	5	4.6	5.8	312	310	340	30
January 10	6	4.5	6.1	318	340	400	60
February 10	7	4.5	7.66+	365	400	450	50
March 10	8	5.25	9	517½	450	500	50
Jersey Steer.—Roscoe.							
January 20—February 23, 1886	1	3		102	252	306	54
*April 10	2	3.33+	3.5	368	306	400	94
May 10	3	4	4	240	400	440	40
June 10	4	5	5	300	440	480	40
July 10	5	6	5.5	345	480	510	30
August 10	6	6	3.8	294	510	563	53
September 10	7	6	4.25	307	563	580	17
October 11	8	6.5	3.25	292	580	646	66
November 10	9	7	9	540	646	700	54
December	10	7.4	10.6	541	700	736	36
January 10	11	7.9	10.7	558	736	790	54
February 10	12	7.75	12	592.5	790	830	40
§March 10	13	8	13	720	830	870	40
Jersey Steer.—Potter.							
June 10–July 10, 1886	1	1	8	270	150	190	40
			Hay.				
August 10	2	2.17	1	95	190	243	53
September 10	3	3.2	2.25	163	243	300	57
October 11	4	3.33+	2.33	170	300	350	50
November 10	5	3.33	7	310	350	406	56
December 10	6	4.2	8.2	372	406	440	34
January 10	7	4.5	10.4	447	440	486	46
February 10	8	4.5	7.66	365	486	548	62
†March 10	9	5.25	9	487	548	588	40

* One pound of roots was fed daily during the second period. § Three pounds ensilage daily for last period. † Two pounds ensilage daily during last period.

The animals have all been thrifty and vigorous during the feeding thus far, and are in fine condition to continue the test.

This bulletin is submitted to the consideration of interested parties without comment.

Comparisons are reserved for a future bulletin.

I shall be pleased to receive any suggestions as to the conducting of the test from any one interested.

SAMUEL JOHNSON,
Professor of Agriculture.

FARM DEPARTMENT,
Agr'l College, March 18, 1887.

No. 25.—VETERINARY DEPARTMENT.

LAMINITIS,

A disease of the foot of the horse, frequently occurring in the summer season.

Laminitis is a disease of the foot of the horse, which is often brought directly under the notice of owners of these animals, and which in many instances, from the want of knowledge of the causes of the complaint, unfortunate creatures are subjected to the most excruciating pain, and their owners to much pecuniary loss, as well as other inconvenience.

The disease has, from time to time, been the subject of much difference of opinion as to its location, consequently, it is known under a variety of names, given according to the fancy of the observer, but the one which we oftenest hear applied to it, by laymen, is *chest-founder*, which term, however, is not altogether appropriate, but may perhaps be excused when we take into consideration the origin of it, and this can be traced to two sources. In the first place it may have arisen from the fact that inflammation of the lungs is sometimes thought to fly from the chest to the feet, but this is of exceedingly rare occurrence, as far as my observation has gone. Secondly, it may have arisen from the fact that *a large majority* of cases brought under our notice have shown that those large round muscles, forming the front of the chest or bosom, and situated between the fore legs, have suddenly vanished as it were, giving the chest a sunken or hollow appearance, which, to the casual observer, might naturally be thought the seat of the disease. This sunken condition of the chest may be explained though, by the fact that animals, when suffering, generally stand up, but throw the weight of the body as much as possible upon hind feet (for obvious reasons), and the muscles forming the bosom become relaxed and appear wasted. To prove that removal of the weight of the body from the fore legs, will produce this sunken appearance of the chest, we have only to take one fore foot of a healthy horse, from the ground, and holding it in the hand, the muscles on the same side of the breast bone will apparently vanish, to however, regain their round original form, as soon as the foot is allowed to descend to the ground.

The simple term, *founder*, is often applied to this disease, the origin of which might be traced to several sources, a striking one is, in one of the meanings of the word, viz.: to fill, or be filled with water, and as it has long been conceded, that water given at improper times, or allowing an animal to fill itself too full, is liable to cause this disease, may not the term appear appropriate ?

The disorder is called "Laminitis," because those delicate little plates, surrounding the inside of the hoof, and called laminæ are the parts most affected, although in bad cases other structures of the foot become involved; I have one specimen in my possession which shows that the disease was so deep seated, as to attack the main bone of the foot. This complaint is one of the most painful that horse flesh is heir to, but this is little to be wondered at, when we recognize the fact that so highly organized a structure as the internal part of the foot of the horse, is suddenly thrown into an acute state of inflammation, and being enclosed in an unyielding box of horn, the hoof, the consequent pressure upon the nerves occasions much pain. To account for which pressure, I may say that it has been admitted, from time immemorial, that swelling to a greater or less extent, is always present with inflammation. By way of illustrating how painful Laminitis must be, let us compare the parts involved, with the parts involved in toothache in man, a disease no doubt familiar to many. Now in toothache we have a highly sensitive structure, *the pulp*, as it is called, and which may be compared to the internal, or sensitive structure of the foot of the horse. And this *pulp* is enclosed in an unyielding case of bone, *the root*, or *fang* of the tooth, which may be compared to the *hoof* of the horse, as both inclose their respective sensitive structures; well, when swelling occurs from inflammation of the *pulp*, the nerve is pressed upon, but being imprisoned in the *fang* it can not accommodate itself to circumstances, so the familiar throbbing pain of toothache is the result, but in the inflamed foot of the horse, there are scores of nerve fibres pressed upon, and when we take into consideration that animals invariably stand while afflicted with this complaint, the weight of the body thus adding "fuel to the fire," we can form some idea what intense agony, the unfortunate creatures must endure.

NATURE OF THE DISEASE.

It may be defined to be inflammation of the sensitive laminæ of the foot, extending to and involving neighboring structures in bad cases.

THE CAUSES

of the complaint are widespread and numerous. I have seen more cases of this disease caused by over-driving on a hard road, than from any other cause, especially when the weather was hot, and the animal not accustomed to long journeys, or out of condition from a day or two's rest.

Driving an animal through cold water when it (the horse) is hot will produce it at times.

Allowing an animal to drink immoderately of cold water while in a state of perspiration, is liable to bring on an attack.

Overloading the stomach with certain kinds of grain, is a fertile source of this complaint. Some of the worst cases I have seen have been the result of animals getting loose at night, and getting to the corn or oat bin, as the case might be. I have seen it follow spontaneous diarrhœa; the injudicious use of purgative medicine will also cause it.

Keeping animals tied in the stall for too great a length of time, as is sometimes done during the winter, or the constrained position necessitated during a long sea voyage, occasionally provokes the disease.

That condition called metastasis, which is the flying of inflammation from one part to another, is thought to occur with, and produce this disease.

I have seen cases occur with metritis (inflammation of the womb), when the symptoms of the first disease subsided, and those of laminitis were plainly exhibited. The disease is sometimes produced in one foot by the careless driving of a nail in shoeing.

THE SYMPTOMS

of the disorder are peculiar and characteristic. In the first place it may be said that in ninety-five cases out of a hundred, the disease attacks the two front feet, though it sometimes invades the hind ones, when the symptoms will be very different in certain particulars.

When both front feet are affected, the animal will be generally found standing, with its back arched, and hind feet carried forward, towards the center of the body, in order that the weight of it may be borne as much as possible by them, and removed from the fore feet. This peculiar attitude often leads the casual observer to think that the animal is strained across the loins.

If the animal is required to move, it will do so with more or less reluctance, stumbling as it goes ahead, or dragging its front feet in an awkward manner if required to back up. The pulse has a very plain throbbing feeling to the finger, is full and bounding, and somewhat quickened. Another peculiarity about the pulse is, that it can be plainly felt upon the side of the leg near the fetlock, and I do not know of another disease where this peculiar condition of the circulation is so plainly exhibited. The breathing will be accelerated, often to such a degree as to lead one not familiar with the malady to suppose that some derangement of the organs of respiration is at work. The muscles in front of the breast appear wasted, from the attitude of the animal, though. The pain of the disease is sometimes so great as to cause tetanic convulsions, or twitching of many of the muscles beneath the skin. I have seen cases where animals were lying down when first visited, and pawing and groaning to such an extent as might easily lead one to suppose that they were suffering from colic or some other enteric disease, hence the necessity for getting an animal upon its feet before forming an opinion as to the disease it is suffering from. I might add that the standing posture is the best one to examine a horse either in health or disease.

When the hind feet are the seat of the disease, the symptoms will be somewhat different, the horse will, to use a common expression, "stand all in a heap," the fore feet being extended backwards and the hind feet carried forwards. If the animal is required to walk, it will do so in a peculiar springhalty, automatic sort of a way. When the hind feet are affected animals often lie down, which attitude must afford them great relief. I have noticed that when animals assume the recumbent position while suffering from this disease, they invariably make a more rapid and thorough recovery, so of course this attitude should always be encouraged.

THE TREATMENT

of this disease materially depends upon the cause, and if it has been produced by spontaneous dirrhœa or the abuse of purgative medicine, anything which will tend to unduly increase the action of the bowels, should be carefully avoided, and those remedies which are used to allay pain and reduce fever may be given with advantage. For these purposes I found great benefit from the use of tincture of Aconite, given in doses of about ten to fifteen drops in a few ounces of water every two hours, until four or five doses have been given. The Aconite may be followed by Nitrate of Potash in two drachm doses, dissolved in half a pint of water every four hours, for from two to four days. On the other hand, if the disease is the result of an overloaded condition of the bowels, the superfluous food may be gotten rid of by the aid of laxatives, say twenty-five fluid ounces of raw linseed oil, will generally answer. The animal should not have anything in the shape of solid food, such as hay or straw, for at least twenty-four hours after the oil is given, but the diet ought to be of a laxative nature; warm bran mashes, and the like, have a good effect. When the laxative has done acting, the Nitrate of Potash may be given as above.

During the last two summers I have had occasion to treat a number of cases, the result of over-driving, on very hot days, and have found very great benefit from the free use of Nitrate of Potash. I gave 1½ ounces in a pint of water every four hours until 3 doses had been given, then stopped for 8 hours, when the doses were to be repeated. I would repeat a second time if the patient was not doing well; laxative food should be given and the animal allowed to drink somewhat sparingly.

The local treatment is of great importance and consists in the application of moisture, in the shape of water, to the feet, which may be applied in the manner most convenient, in moderate weather. I have found very beneficial effects from standing an animal in a stream of water for several hours a day, taking care, however, that their bodies were well protected from inclement weather, or hot sun.

When animals have a desire to lie down, apply wet swabs to their coronets. In other instances a puddle made with blue clay and water, about the consistence of fresh, glazier's putty, to which a few handsful of salt may be added, has proved useful. The puddle should be made so that the horse will sink into it, for from about four, to six inches.

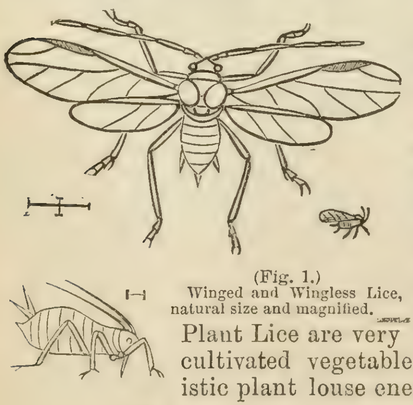
Exercise should be given from the first, and should be repeated three times a day, being increased from say ten minutes to half an hour at a time, as the horse gets better. Animals that progress favorably from the beginning may be driven moderately in about two weeks.

E. A. A. GRANGE,
April 30, 1887. *Prof. of Veterinary Science.*

No. 26.—DEPARTMENT OF ZOÖLOGY AND ENTOMOLOGY.

PLANT LICE AND THE CODLING MOTH.

Perhaps no family of insects is more widely distributed, more generally destructive and better known than Plant Lice. (Fig. 1.)

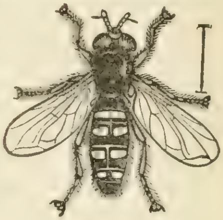


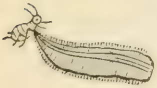
(Fig. 1.)
Winged and Wingless Lice, natural size and magnified.

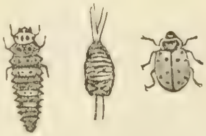
In our green-houses, on window plants, and on almost all outdoor vegetation their harmful work is seen. Nor do they confine themselves to any single part of a plant. Some work on the roots and sap the vitality of the herb or tree; others draw their nourishment from the stems and twigs, and thus blight the plants; still others suck the vitality from bud and foliage. A few, possibly more than we are aware of, work on both roots and leaves. It is also true that Plant Lice are very generally distributed. Most all of our cultivated vegetables, grains, and trees have their characteristic plant louse enemies. Not only are these insects widely distributed, but when present in any considerable numbers they do great damage. Every lady who keeps house plants knows this full well.

As is well known, plant lice on outside vegetation pass the winter as little, dark oblong eggs, usually fastened to the buds. With the warm days of spring these eggs hatch, and so rapidly do the lice increase that soon, by the middle or last of May, the lice are often counted by millions and billions. Sometimes they start off in great numbers in spring. I have seen apple trees in April when hardly a bud could be found that was not the home of lice, and I have counted as many as fifty lice on a single bud. Surely there is not much promise in such a bud.

Another feature which is very characteristic of plant lice, is their sudden disappearance. Our cherry trees may be black with them in May, and within a month the lice may be so used up that we can hardly find a specimen. The same is true of nearly all the species that infest our out-door plants and trees. This welcome riddance is due to insect enemies of the lice. A syphus fly (fig 2) maggot (fig 3), with a pointed head just revels amidst the plant lice. This maggot seems never satiated. It is hard to understand how so small an insect can take so large a meal. The maggots are constantly banqueting on the plump, juicy lice. The lady bird beetles (fig. 4), especially the larvæ or grubs also do signal service in this same direction. Last year, owing I think to the excessive drouth, plant lice were very common. This gave the lady bird beetles a rich opportunity, and often we might see thousands of the active grubs on a single tree. The sad feature in this case was that many people, through ignorance, thought that these insects were the real culprits, and so destroyed them by the thousands. We have also found several species of the Ichneumon family of the genus Aphidius, very minute parasites, which destroy these lice by the thousands. Thus it is that plant lice on out-door vegetation, though they may threaten dire mischief early in the spring, are almost vanquished before summer comes. Occasionally a year like last year (1886), owing probably to the excessive drouth, the plant lice thrive out of proportion, and succeed in spite of their enemies, when they do most serious injury. Owing to this scourge, many an orchard which promised bountifully in the spring of 1886 failed almost utterly to bear good fruit.


(FIG. 2.)
Syphus Fly.


(FIG. 3.)
Maggot.


(FIG. 4.)
Larva, pupa and beetle.

In some cases, as in the snow ball, the leaves roll up and protect the lice from their eager foes, and thus these beautiful shrubs are likely to suffer seriously each year, even if they are not wholly destroyed through the blighting presence of plant lice. Other plants, like the white willow, are likely to suffer seriously about one year in four.

REMEDIES.

I have found nothing so satisfactory in treating plant lice as the kerosene and soap mixture. To make this I use one-fourth pound of hard soap, preferably whale oil soap, and one quart of water, or one quart of common soft soap and one quart of water. This is heated till the soap is dissolved, when one pint of kerosene oil is added and the whole agitated till a permanent emulsion or mixture is formed. The agitation is easily secured by use of a force pump, pumping the liquid with force back into the vessel holding it. I then add water so that there shall be kerosene in the proportion of one to fifteen.

On the snow ball we find that this mixture, in the proportion of one to eight, used just before the plant lice eggs hatch is astonishingly efficient. A twig not treated and one from the same bush that had been treated were each put into a glass bottle in a warm room. In a few days the one bottle was alive with the newly hatched lice, while in the other only one live louse was found. Bushes side by side, the one treated and the other not, gave equally satisfactory results. This early treatment is absolutely necessary in such cases as the snow ball, and is to be recommended on the score of economy in case of nursery stock and fruit trees. It is easier and requires less of the liquid to thoroughly drench a leafless tree than one in full foliage. It is also less difficult to make the application *very thorough, which is* ALL IMPORTANT. We have just applied this liquid to orchard trees where the buds were literally covered with lice, and we find the lice totally used up. In counting two hundred one live louse was found.

We are very pleased to learn that this early treatment is so efficient. As just suggested, this liquid must be applied with energy. If used for the adult lice, or for eggs, or newly hatched lice, and it is not effective, it is only because it is applied too gently. We must use a good force pump and dash the liquid onto the plants so it will scatter everywhere and reach every egg, even though these latter are crowded between the buds and the stem and reach every louse, even though they are sheltered by myriad leaves. Just here is where some will fail; they will sprinkle the liquid gently down, and so not reach one-half the eggs or lice.

PUMPS.

A. I. Root, Medina, Ohio, sells a force pump for $1. Though not equal to the Whitman, it is excellent for the price, and for a few plants answers fairly well. The Whitman Fountain pump, J. A. Whitman, Providence, R. I., is excellent, and is just the thing for those who have a small yard or a few fruit trees. This costs $6.50 at the factory.

The Field Force Pump Co., Lockport, N. Y., sells a similar pump which works well, for $2.50, iron, or $3.50 if brass.

The Nixon pump, Dayton, Ohio, is supplied with a tank and rests on casters. It is also supplied with a superior spraying nozzle which throws a very fine spray with great force. This for general use is superior even to the cyclone nozzle, though the latter is preferable for spraying the under side of leaves on low bushes. This pump is very convenient in the garden and in small fruit plantations. Price $15.

The Field Force Pump Co. sell a similar garden engine which is supplied with a 40-gallon tank mounted on two strong wheels and furnished with hose and the "Boss nozzle" for $20.

For large orchards, the Field Force Pump Co. sells a very excellent two cylinder double acting force pump with "Boss nozzle," combined with Moody's patent gearing, which fastens to the wheel of a wagon so that the wagon runs the pump. The entire apparatus costs $30; gearing alone, $15. This pump is a great desideratum to one with a considerable orchard, and could also be used with great satisfaction in the potato field in destroying the beetles. It is no small advantage to have the handle worked by horse power. In this there is a separate hose that goes to the bottom of the barrel or tank holding any liquid, and so acts as an automatic stirrer.

LONDON PURPLE OR PARIS GREEN FOR CODLING MOTH.

In Bulletin 14, issued a year ago, I urged, as I have for several years, the value of the arsenites in fighting the codling moth. I only wish to add at this time a few hints that I am sure will be of aid to any who contemplate making use of this excellent remedy. If all would practice it millions of dollars would be saved to our people.

First, Use London purple or Paris green, and not white arsenic. London purple is cheap, mixes easily, and perhaps is a little less likely than Paris green to blight the foliage if used too freely.

Second, Apply early, just after the blossoms have fallen, when the apples are the size of small peas. If we wait longer than this some of the insects will have entered the apples and be beyond reach of harm, and so we shall partially fail of success.

Third, Use a diluted mixture, not more than one pound of London purple or Paris green to two barrels or 100 gallons of water. If I were to make any change at all it would be to make it more dilute, rather than stronger. If kept stirred, as it should always be while being used, we note that the liquid is evenly colored. This proves that poison is in every drop of water. I have proved repeatedly that the faintest trace of this poison is sure death to the wee insects. So it is not large doses, but thorough distribution that is needed. Not that there is not poison enough on each apple, but that many apples have received no poison at all. If as dilute as recommended above we may scatter so thoroughly as to reach nearly every fruit and yet not scald or blight the foliage. It stands to reason that in using poisons it is always best to use the minimum quantity necessary to success.

Fourth, Apply the poison with great force. The apples are concealed and protected by many leaves, and to insure contact of the poisonous liquid with the calyx end of each apple, it must be dashed on to the tree with great energy, then it will scatter and every apple will receive the fatal atom and every larva be killed. The neglect of this caution is why some have only saved 75 per cent of the fruit. I have frequently saved every apple, and that with only one application, but this was in time, and absolutely thorough. Lastly, be sure that the mineral is well mixed. This is best done by grinding first in a little water and then adding the full complement.

I have already discussed the subject of pumps. There is no question but that the one last mentioned is the pump for the large orchardist.

No one need fear to use this remedy. If the orchard is used for pasture, stock better be kept out of it for a few days. The poison should never be handled with the bare hands, nor should it be used when there is a wind to blow the spray or dust on to the person using it. But most important of all, be careful where the poison is left. No poison ought ever to be left unlabeled, and poisons ought always to be put where they cannot possibly do any harm.

Carelessness in handling is the cause of nearly if not all the accidents which result from such poisons. I wish to thank C. P. Gillett, whose painstaking, conscientious and intelligent assistance has been of great value to me in these experiments.

A. J. COOK.

Agricultural College, Mich., April 30, 1887.

No. 27.—CHEMICAL DEPARTMENT.

COMMERCIAL FERTILIZERS—INSPECTION FOR 1887.

Act No. 28 of the Session Laws of 1885 requires the analysis each year of every commercial fertilizers offered for sale in this State if its retail price exceeds $10 a ton. The manufacturers of fourteen different brands of such fertilizers have applied to the Secretary of the Board of Agriculture for a license to sell said fertilizers and deposited the fee required by law. I have gathered in the open market specimens of these fertilizers, analyzed them, and present in tabular form the results of such analysis in comparison with the composition as claimed by the manufacturer. By comparing the composition as it is "claimed" and "found," one can readily see whether the fertilizer comes up to the standard.

This law is designed to guard the public against fraud by preventing the sale of inert or spurious materials in the place of substances really valuable.. When we consider that leached ashes and soap-boilers' waste have been offered for sale as "superphosphate," and a premium claimed for such "superphosphate" from the State Agricultural Society, and that parties in a neighboring State endeavored to sell marl as "Buckeye Phosphate," we see that State supervision is necessary to protect the public.

The law does not prescribe what the fertilizer shall contain, but holds the manufacturer rigidly to the standard he sets up for his own fertilizers in respect to the three most important ingredients, viz.: available nitrogen, phosphates, and potash.

The inspection required by this law gives no information about the use of the fertilizers, the kinds of soil best adapted to their profitable use, the kinds of crops most benefited, the time to apply them or the quantity to use. This desirable information does not come within the scope of this investigation. Some day I hope to issue a Bulletin to discuss some of the above topics, but the public must remember that the chief object of this law is to prevent fraud.

If any one wants to estimate the money value by the commercial value of the three principal ingredients, he can readily do so by taking the value of nitrogen as 18 cents a pound, of soluble phosphoric acid 8 cents, of reverted phosphoric acid 7½ cents, of insoluble phosphoric acid 5 cents, and potash as 5 cents a pound. For example, take a fertilizer containing 3 per cent of active nitrogen, 7 per cent soluble, 2 per cent reverted and 1 per cent insoluble phosphoric acid, and 2 per cent of potash. This would give the following results for every 2,000 pounds:

60 lbs. nitrogen, @ 18 cents	$10 80
140 lbs. phosphoric acid soluble, @ 8 cents	11 20
40 lbs. " " reverted, @ 7½ cents	3 00
20 lbs. " " insoluble, @ 5 cents	1 00
40 lbs. potash, @ 5 cents	2 00
Value of one ton	$28 00

Results of Analysis of Commercial Fertilizers, as

Manufacturer. Place where Made.	Trade Name of Fertilizer.	Where Specimen for Analysis was Selected. Name of Dealer.	
Crocker Chemical Works, Buffalo, N. Y	Ammoniated Bone Superphosphate	Lansing, Mich., A. Aber	Claimed Found
Crocker Chemical Works, Buffalo, N. Y	Potato, Hop, and Tobacco Phosphate	Lansing, Mich., A. Aber	Claimed Found
Crocker Chemical Works, Buffalo, N. Y	Pure Ground Bone	Lansing, Mich., A. Aber	Claimed Found
Crocker Chemical Works, Buffalo, N. Y	Vegetable Bone Superphosphate	Flint, Mich., F. A. Platt	Claimed Found
Crocker Chemical Works, Buffalo, N. Y	Queen City Phosphate	Flint, Mich., F. A. Platt	Claimed Found
Crocker Chemical Works, Buffalo, N. Y	Buffalo Superphosphate, No. 2	Lansing, Mich., A. Aber	Claimed Found
Crocker Chemical Works, Buffalo, N. Y	Ammoniated Wheat Phosphate	Lansing, Mich., A. Aber	Claimed Found
North Western Fertilizing Co., Chicago, Ill	Garden City Superphosphate	Flint, Mich., Castree Mallery Co.	Claimed Found
North Western Fertilizing Co., Chicago, Ill	Challenge Corn Grower	Flint, Mich., Castree Mallery Co.	Claimed Found
North Western Fertilizing Co., Chicago, Ill	Twenty-six Dollar Phosphate	Flint, Mich., Castree Mallery Co.	Claimed Found
North Western Fertilizing Co., Chicago, Ill	Fine Raw Bone	Factory	Claimed Found
Walton, Whan & Co., Wilmington, Del	Diamond Soluble Bone	Big Rapids, Mich., Mr. Clark	Claimed Found
Michigan Carbon Works, Detroit, Mich	Drill Phosphate	Manufactory, Detroit, Mich	Claimed Found
Michigan Carbon Works, Detroit, Mich	Homestead Superphosphate	Grand Haven, Geo. Hancock	Claimed Found

Agricultural College, Aug., 1887.

The foregoing values of these substances are the average trade values or retail cost in market as agreed upon by the Experiment Stations of Connecticut, New Jersey and Massachusetts for 1886. They represent the trade value and not the agricultural value of these materials.

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required by Act No. 26 of Session Laws of 1885.

Composition of Fertilizer as Claimed by the Manufacturer and as Found by Analysis.

Nitrogen.		Phosphoric Acid, P_2O_5.					Potash, Soluble in Water.	
Active Nitrogen.	Nitrogen as Ammonia.	Soluble, P_2O_5.	Reverted, P_2O_5.	Available, P_2O_5.	Insoluble, P_2O_5.	Total, P_2O_5.	As Oxide, K_2O.	As Sulphate, K_2SO_4.
2.9 to 3.7	3.5 to 4.5	6 to 8	2 to 4	8 to 12	1 to 2	9 to 14	1 to 3	2 to 6
2.76	3.28	7.00	2.50	9.50	1	10.50	1.10	1.70
2 to 3	2.5 to 3.5	6 to 8	2 to 4	8 to 12	1 to 2	9 to 14	3.5 to 4.5	6 to 8
2.59	3.14	7.29	2.89	10.16	1.18	11.34	3.50	6.36
2.9 to 3.7	3.5 to 4.5	------------	------------	------------	25	25	------------	------------
3.50	4.25	0	0	0	23	23	0	0
5 to 6	6 to 7	4.5 to 5.5	1.5 to 2.5	6 to 8	1 to 2	7 to 10	6 to 8	11 to 15
4.25	5.15	3.5	2.59	6.09	32	6.41	5.00	9.20
1.65 to 2	2 to 2.5	6 to 8	2 to 4	8 to 12	1 to 2	9 to 14	1 to 2	2 to 4
1.80	2.20	6.16	5.00	11.16	1.00	12.16	1.07	1.6
0	0	10 to 11	1 to 2	11 to 13	1 to 2	12 to 15	1 to 2	2 to 4
0	0	10.18	2.88	13.06	.75	13.81	1.17	1.80
2 to 3	2.5 to 3.5	------------	------------	10 to 13	1 to 2	11 to 15	2 to 3	3 to 5
2.50	3.00	8.23	2.37	10.60	.80	11.40	2.16	3.30
1.64 to 2.47	2 to 3	------------	------------	9 to 11	2 to 4	11 to 15	1 to 2	
2.50	3.00	5.98	4.48	10.46	2.12	12.58	1.50	
1.64 to 2.47	2 to 3	------------	------------	9 to 11	2 to 4	11 to 15	1 to 2	
1.68	2.10	7.06	1.44	8.50	3.85	12.35	1.00	
1.23 to 1.64	1.5 to 2	------------	------------	6 to 8	2 to 4	8 to 12	------------	------------
1.60	2	7.53	2.37	9.90	3.38	13.28	0	0
2.50	3.00	------------	------------	------------	23 to 25	23 to 25	------------	------------
2.50	3.00	0	0	0	23.00	23.00	0	0
.44 to .88	.5 to 1	------------	------------	13 to 15	1.5 to 3	15 to 17	------------	------------
.50	.60	10.13	3.74	13.87	1.96	15.83	0	0
1 to 2	1.25 to 2	7 to 8	.50 to 1.50	7.5 to 8.5	2 to 3	9.5 to 12.5	------------	------------
1.05	1.25	8.9	.26	9.16	3.23	12.39	0	0
1.85 to 2.40	2.25 to 3.15	7 to 10	1.	8 to 11	00	8 to 11	1.48 to 1.90	2.75 to 3.50
1.96	2.38	6.91	3.88	10.79	.72	11.51	1.75	3.23

R. C. KEDZIE, *Prof. Chemistry.*

No. 28.—BOTANICAL DEPARTMENT.

FOREST PRODUCTS OF THE MUSEUM OF ECONOMIC BOTANY.

Some years ago the writer was consulting an eminent professor in an Agricultural College in reference to plans for a museum of vegetable products. After a little he exclaimed somewhat as follows: "What do you want of a museum, anyhow? What is it good for after you collect it and put it in order?"

The present bulletin is prepared, among other things, to partially answer such questions. It is true that our classes have the long vacation in winter when vegetation is dormant. It is true that during most of the period for class-work, our students have the advantage of a rich native flora, a park, an arboretum, a botanic garden, a greenhouse, with flower beds in summer, vegetable and fruit gardens, orchards and fields. These contain vastly more than any student can make use of, or can comprehend, although large numbers of these things are plainly labeled. Notwithstanding all of these there still seems to be need of a museum.

The second story with a gallery above, in the building devoted to botany, is used for a museum of plant products. There are about 4,000 square feet of floor surface in the museum. Many of the specimens are in well made glass cases. At present I shall only speak of the timber collection or forest products.

Some portions of these specimens were collected and exhibited at Philadelphia in 1876, and again at New Orleans in 1884. For these exhibits the college has received two diplomas.

As a visitor passes about the rooms, he sees plainly labeled a collection of natural root-grafts of large pine stumps, white cedar and beeches, and fifteen or twenty natural grafts of stems above ground, including a union of two beech trees, each about fifteen inches in diameter. They were united twenty-five feet above ground by a branch about seven feet long, which is about six inches in diameter in the smallest place. United they stood, united they fell, and still remain one and inseparable. One of the most interesting natural grafts is that of a black oak and a white oak—oaks belonging to widely different sections of the genus. Other specimens illustrate various stages in the process of uniting.

Natural grafts of the stems of silver maples are more common in this vicinity than those of any other species. They frequently sprout at the ground, forming several trunks; the bark is thin and the trees grow rapidly.

Here are roots of white willow which had run a hundred feet to fill a three-inch tile twice in four years, and a large mat of roots which had filled one-third of the diameter of a tile eighteen inches in diameter. And here are some roots from a cottonwood which had run a long way and filled a tile. The willows and the cottonwood and some elms were felled to prevent further trouble.

When a long limb grows in a position where the end is much swayed back and forth by the wind, its base will thicken to enable it to stand the strain, making a large, stout shoulder. In a similar manner the base of a second-growth tree which has grown in an exposed place will be broad, stout and tapering; while one in a dense forest not so exposed will be much more nearly cylindrical near the ground. Specimens from the college grounds in the museum illustrate this fact.

Three specimens—two of oaks and one beech—each contain a deer's antler imbedded in the wood, where two of them had been completely covered. A broken chain link was found when a stick of maple was split.

Here are thirty-one young trees of full length, usually nine years old, taken from our arboretum.

An assortment of slabs, carefully selected, illustrates the barks of most of our leading sorts of native trees, some of which are already scarce or wanting in many neighborhoods.

There is a large assortment of knots from most of our species of trees. These are to illustrate the damage which is done to a tree by dead knots. Some sound knots are cut and polished, and some that are defective are also cut to show this fact. Limbs of an apple tree and another from a buttonwood show two series, illustrating the various stages in healing over.

The trunks of some trees are very winding. To illustrate this are two ironwoods, a tamarack, a white cedar and a yucca.

Next we come to numerous examples in which one limb or tree had damaged another by rubbing or growing against it. Of such we have the blue beech, silver maple, white ash, locust and others. Vines of various kinds wind about and damage trees or branches. Here a bittersweet has died in the first attempt to strangle a white oak. A branch was repeating the operation when the specimen was brought to the museum.

A vine of moon seed about a blue beech illustrates precisely the same condition of things. A grape-vine over one hundred feet long winds gracefully about among the upper timbers of the museum, and a section of another is about seven inches in diameter.

Next we come to some trees badly scarred and healing over where floating ice had passed by in the spring, And next we notice how maples, hickories, oaks and basswoods were shivered or bent in different manners by a tornado. A photograph illustrates barns, houses, orchards much damaged on the spot where they were entirely demolished.

There are pieces of the trunks of a basswood, white ash, white oak, showing the work of lightning. Next appear three miserable looking specimens, showing the struggles of a poplar and two maples to heal over their wounds made by horses hitched to them for want of suitable posts.

Specimens illustrate the damage done to maples by sap-spiles, and others the attempts to heal over where the bark had died, or the trunk had been checked. These beeches, maples, basswoods, show the effect of sap-suckers, which dug for the cambium layer years before. There are no indications of any insects. A squirrel kept this hole open where a limb had died; woodpeckers had made these holes in decaying poplars for their nests; and here are a large number of boards, blocks, bark, limbs, showing the effect of borers. Larvæ of numerous insects as they had damaged apple trees, locust, hickory, ash, oak, tamarack, pine, and there hangs a small tree with all its branches. The latter was a Scotch pine, and died soon after setting in spring. Beetles ate the young wood and young bark, so the outer bark was easily removed.

Here is a good start towards a collection of tough wood of our valuable oaks, hickories, ashes, elms, ironwood, beech, basswood, and near them should be placed samples of brash or defective woods. Near by are two samples showing how two elm boards warp when exposed to the sun on one side only, and showing which way the board near a slab or the side of a log will warp. Also near them a large number of specimens showing various defects in wood caused by branches, checks, decay, etc.

Here are four panels, each eight by fourteen feet, covered by polished boards, and some not polished, each usually eight by sixteen inches. There is an assortment of duplicates, especially of our most valuable woods, and show various good and weak points, different sections, etc. The enterprise of one grange is still manifest by the large gilt letters as follows, "Sassafras, by Port Huron Grange, Mich., No. 480."

In the ceiling of the wall, by some choice native woods, a chestnut board from Wayne county shows a bullet left long ago by some marksman. One suit of specimens contains the core of a birch log three feet long, which had been steamed and the veneering turned off. This was dried, several layers placed at right angles to each other and pressed, and held together by hot glue. The surface of the veneering cut around the log in this way is often very beautiful, and presents a different appearance from boards cut from a log.

There is a beginning of a collection of cork, tan-bark, sawdust, thin wood for covering walls of houses, business cards made of cross sections of two sorts of soft maple, four large samples of hard wood mosaic suitable for floors of dining rooms. Here are short cross sections steamed and stamped to imitate carving, and they are very pretty.

Over there are some young trees twisting about each other, doubtless the work of some student, and a beech slab, with names and dates carved in the bark; a vine of Virginia creeper, with an enlargement above a string tied years ago; a hollow buttonwood log, such as was once used for smoke-houses, samples cut through the heart, showing that a young tree grows straighter as it grows older, by filling in most in the hollows; samples of American elm and catalpa, in which the defect of weak crotches is illustrated; samples of maple, white and blue ash, and beech and walnut that are curly; blocks showing bird's eye maple, as seen below the bark, as well as in polished boards. There are fifty-four sticks of wood of thirteen kinds of timber, once set in the ground to decide whether it was of any use to set posts top end down to increase their durability. The results were given in a former report, and show that it makes no difference which end up the post is set. Here a few rough boards of our leading sorts of timber for students to study, also boards to show some of the grades of white pine, and cross sections to show the various ways in which unprotected logs check at the end; several hundred truncheons, a polished cross section of each native tree, samples of Michigan willow ware, with willow as it grew, some peeled, some split; a lot of nuts, fruits, cones and seeds of trees; cocoanuts, coacoanut fibre, tampico used instead of hair for brushes, and "rice roots" used for coarse brushes. There are the gums and dyes, mostly from the pulse family, some St. John's bread (sweet edible pods), some wood from the bottom of a deep well in Dakota where no wood is now found; products of southern pines, as turpentine, lampblack, rosin, tar. We have some wood-pulp for making paper, and samples of charcoal, and other products taken from the kilns.

In one case are partially decayed limbs, boards, black knot of plum, cherry, oak, hickory, etc. These knots are caused by certain fungi. Wood will not decay until bacteria and other fungi work upon it. Here are cedar apples, caused by a fungus, and galls caused by insects.

So far as practicable, all of these things are placed together, according to the natural orders to which they belong. In collecting specimens, most attention is given to our own common native and useful trees. An effort is made to illustrate woods as manufactured, or partially manufactured, as well as in the natural condition. For want of room, many articles will be made in reduced size. For example, it is intended to show sashes, doors, blinds, pieces of moldings, flooring, well and poorly cut, weather strips, canoes, oars, tackle-blocks, spokes, neck-yokes, poles, shafts, hubs, rims, saddle-trees, hames, handles of hoes, forks, shovels, chisels, planes, mallets, spools, lasts, kegs, barrels, hoops, baskets, matches, wooden-ware, etc., etc. In time a guide book should be issued for the use of students and visitors.

In the museums of the Kew Gardens, near London, the timbers of the different countries are separated from each other.

The following quotation from the last guide book to the museum of economic botany at Kaw states the object of the museum to show the practical application of botonical science: "They teach us to appreciate the general relations of the vegetable world to man. We learn from them the sources of the innumerable products furnished by the vegetable kingdom for our use and convenience, whether as articles of food, of construction and application in the arts, of medicine or curiosity. They suggest new channels for our industry. They show us the variety in form and structure presented by plants, and are a means of direct instruction in most important branches of useful knowledge.

"We see from them the particular points upon which further information is needed, especially as to the origin of many valuable timbers, fibres and drugs, in order to perfect our knowledge of economic botany. In brief, the museum shows us *how little* as well as *how much* we know of the extent to which herbs, shrubs and trees contribute to our necessities, comforts, and numberless requirements."

Museums containing mounted mammals, birds, reptiles, skeletons, fishes, shells, fossils, insects, minerals, Indian relics, other animals in alcohol are not uncommon. They are very interesting and instructive. But a museum devoted wholly to plant products is not so common. If well selected, arranged and fully labeled, a visitor with a little time and some application never fails to find much that is new and worth knowing. This museum is for the instruction of the students in the mechanical course, as well as for those in the agricultural course.

The large and increasing numbers who visit our museum above mentioned and the comments they make indicate that it already possesses many attractive features, not only in the timber products here noticed, but in numerous other collections.

W. J. BEAL,
Prof. of Botany and Forestry.

September 25, 1887.

No. 29.—VETERINARY DEPARTMENT.

A NEW CONTAGIOUS DISEASE AMONG HORSES IN AMERICA.

It has been observed for some years past by those investigators, who have devoted their talents to the advancement of science, that as the commercial intercourse between countries becomes more and more developed, the greater becomes the geographical distribution of contagious diseases, and as a conseqence we find this continent, every now and again, coming in for its share of the burden of some new plague, and recently we find, on enquiring into the health of domestic animals, that it is our unpleasant duty to have to chronicle the introduction of an unwelcome visitor, presumably from France, and bearing the name of "Maladie du Coït," which name has been given to the complaint by French scientists, owing to the peculiar manner in which most animals contract the disorder. While the Arabs, who have long known the disease, call it El dourine, or Dourinn.

Speaking briefly of the early history of the malady, I may say that it was first observed in Eastern Europe during the latter part of the 18th century, but it was not until our own time that it made its appearance in some of the more westerly countries of that continent, when it invaded several parts of France, and was traced to the importation of a stallion, brought from Syria in Asia, in 1851. French veterinarians think that from the close resemblance of the climate of the two countries, the germs of the complaint, having found a suitable abode in the southern part of the French continent, have come to stay. We now find from newspaper reports, as well as from the very interesting report of the Territorial Veterinarian of Wyoming, that the disease has prevailed in Illinois, even to an alarming extent in some parts, within the last three months; but through the vigilance of the veterinarians in charge, and the State live stock commission, the malady has been confined, as far as I am aware, to McLean and DeWitt counties, in the center of the State.

With regard to the introduction of "Maladie du Coït" into the United States, it must be admitted that the exact source from which it came is still wrapped in great obscurity; there is an idea, however, that it was imported with a black Percheron stallion in 1882, but it does not appear to have spread from this horse, in a virulent form at all events, until last spring. Since then about forty mares and two stallions are reported to have perished through the influence of this mysterious complaint.

Still further with regard to the introduction of the plague, Territorial Veterinarian Hopkins tells us, in his recent report, that, "it is claimed by some creditable horsemen in DeWitt county, Illinois, that it was brought from Texas," and says further, "it appears that in 1885 a large number of mares were brought from Texas, and stinted to Percheron horses, and shortly afterwards the disease appeared among the stallions who served the mares," but at the conclusion of the paragraph says: "After much enquiring into this rumor I am obliged to state that I don't believe that it has any foundation in fact."

As this plague is sure to spread unless it is prevented from so doing by the most vigilant preventive measures, and the close observance of strict quarantine upon the first signal of alarm, and in order that it may be headed off, as it were, I shall endeavor in this Bulletin to describe the peculiarities of the complaint, so that it may be recognized by those interested in horse-flesh, should it cross the boundary lines of Michigan.

Maladie du Coït, or Dourinn, may be regarded as a malignant venereal disease, and as far as I am aware, is peculiar to solipeds (animals having no division in their foot), though some have regarded it as the same as syphilis in man, but experiment has so utterly failed to prove the assertion, that our best authorities have discarded that idea, when discussing the nature of the disease. That it is of a contagious nature, has been proved beyond all reasonable doubt, but it is stated that the virus is of a fixed nature, and that it requires actual contact before the disease can be contracted. Though other authorities say that it may be transmitted from unhealthy to healthy animals, by men who handle the sick ones; and as there is considerable discharge from certain parts of the body during the progress of the disease, I think very probably that it is sometimes spread by careless handling of sick and healthy animals.

The period of incubation in this disease is often very short, being only a couple of days, but certain forms of the complaint are said to remain latent in the system for as much as two months.

MORTALITY OF THE DISORDER.

The percentage of deaths from this complaint vary very much, running up in some instances to as high as seventy per cent. It is not only the mortality of Dourinn that makes it so much to be dreaded, but when we add to this the trouble and expense of treatment, the length of time it takes to effect a cure, and the length of time it takes to get the animal back into its former condition, even when it is cured, we can then form some idea how important it is to prevent the disease from spreading.

SYMPTOMS.

As this disorder has not existed long enough in this country for us to have become familiar with all the symptoms, and as I have not had an opportunity of investigating it myself, I shall have to draw on those transatlantic writers upon the subject, who have been more favored in this respect than myself.

The disorder appears to manifest itself in a variety of ways according to the animal affected, and also according to the severity of the attack. In some the onset, course, and termination are so mild and favorable that it has been called the benign form of the disease, in contradistinction to that form which produces the most disastrous lesions, and frequently the death of the animal, and hence called the malignant form of the disease. So we have the benignant form in the mare, the benignant form in the stallion; the malignant form in the mare and the malignant form in the stallion to discuss.

Of the benignant form in the mare, let me say that she exhibits more or less uneasiness of her private parts, by whisking her tail from side to side, and would give one the idea at first as if she were coming in season, but this is soon followed by more evident signs of disease, for the vulva becomes swollen, and the lining of it is marked with red patches, which soon develop into pustules or ulcers. These ulcers soon disappear, to be followed in a short time by others, and after a variable number of these crops, the disease seems to wear itself out, and disappears without leaving any evil results.

The duration of this mild form has been observed to last for two months, though it usually terminates in about two weeks.

The benignant form in the stallion is not so well marked as in the mare, though, if carefully observed, there will be noticed evident and irritable swelling of the prepuce (sheath), extending in some instances to the yard, causing more or less collapsus of it, and like the benign form in the mare, will sometimes disappear without causing any severe lesion, though this favorable termination cannot always be depended upon, for often, from want of attention, or other cause it develops into the malignant form.

The malignant form of the disease in the mare is much to be dreaded, for its onset and course are frequently so aggravating as to cause the most distressing symptoms, and death in the end.

It is ushered in with the same general symptoms as are exhibited in the benign form, but soon we have a strong smelling catarrh from the mucous membrane of the vagina. On the outside of the vulva, as well as upon the delicate skin of the thighs, and under the tail, will be found circular abrasions. The emission of urine gives rise to much irritation, even amounting to excitement. The animal becomes hide bound, and swellings appear in various parts of the body—circular in outline, and say a couple of inches in diameter. They disappear after a time, to however, make their appearance in some other part.

Then we have frequently nervous complications to contend with, producing in some animals a degree of marasmus hideous to behold.

The animal, if required to walk, will do so in a very uncertain manner, showing that, to a great extent, it has lost control of its joints, which indeed may be much tumified. Things keep going from bad to worse, until death eventually closes the scene.

The malignant form in the stallion is often a sequel to the benignant, and is, therefore, ushered in with the same characteristic symptoms. The yard and other contiguous parts will be marked with abrasions similar to those of the mare. The act of urination causes pain, showing that the lining of the urethra must be involved. The animal will soon begin to lose condition and become weak. If required to walk or trot, will govern himself is a very awkward manner, swaying from side to side, and sometimes falling. Other general symptoms are so like those of the mare that they do not require description.

The malignant form of the disorder may extend through a period of months or even years before it will have run its course.

SANITARY MEASURES TO BE ADOPTED FOR THE PREVENTION OF AN OUTBREAK.

I may say in connection with the disease under consideration that prevention is not only better, but more easily accomplished than cure, by abstaining from the importation of mares or stallions for breeding purposes, from infected districts. When the disease prevails in a State or territory, all stallions used for breeding purposes, should be carefully examined by a competent person every now and again, and the slightest symptoms dealt with accordingly.

Of the treatment of this complaint I am sorry to say it has not been very satisfactory up to the present, that is, when the disease manifests itself in the malignant form, but the preparations of mercury have gained some favor both as external and internal remedies. The local treatment consists in the application of caustics to the ulcers, and this may be followed by an astringent, such as, say, an ounce of sugar of lead to the pint of water, smeared upon the parts two or three times a day.

In cases where weakness is exhibited in the hind quarters, much benefit may be gained by the application of a counter irritant to the loins.

The constitutional treatment consists in the administration of both vegetable and mineral tonics.

E. A. A. GRANGE,
Professor Veterinary Science.

Agricultural College, Michigan, October 1, 1877.

No. 30.—DEPARTMENT OF PRACTICAL AGRICULTURE.

[Bulletin No. 31 is a reprint of the report of Professor Bailey pp. 64—ante.]

FEEDING STEERS OF DIFFERENT BREEDS.

In March last we published a bulletin (No. 24) which outlined in some degree the proposed experiment of feeding good representatives of some of the best known breeds of cattle from calfhood to maturity, under the same conditions. This bulletin also contained the breeding of the ten animals secured for this purpose, viz.: two each of pure bred Galloways, Short Horns, Holsteins, and Jerseys; one Hereford and one Devon, with a complete record of the food consumed, daily ration, monthly weights, and gains up to March 10, 1887.

Name of animal.	Breed.	Date of birth.	Weight Oct. 10, 1887.—Pounds.	Gain per day from birth to Oct. 10, 1887.—Pounds.	Amount of grain from June 10, 1886, to Oct. 10, 1887.—Pounds.	Amount of hay from June 10, 1886, to Oct. 10, 1887.—Pounds.	Gain per day from June 10, 1886, to Oct. 10, 1887.—Pounds.	Amount of food for every pound gained from June 10, 1886, to Oct. 10, 1887.—Pounds.	
								Grain.	Hay.
Latitude	Devon	Mar. 23, '86	820	1.45	2,228	2,413	1.33	3.43	3.71
King Jumbo	Galloway	Feb. 17, '86	1,050	1.75	2,617	2,937	1.48	3.62	4.07
Judge	Galloway	Jan. 1, '86	1,266	1.95	3,261	3,862	1.64	4.08	4.84
Hendricks	Hereford	Oct. 27. '85	1,100	1.54	2,540	3,381	1.12	4.65	6.19
Potter	Jersey	Feb. 25, '86	925	1.56	2,205	2,771	1.58	2.85	3.57
Roscoe	Jersey	Aug. 27, '85	1,046	1.35	3,835	3,937	1.16	6.77	6.95
Beltz	Holstein	Nov. 17, '85	1,406	2.03	4,051	4,422	1.72	4.85	5.29
Nichols	Holstein	Feb. 26, '86	1,126	1.9	2,972	3,172	1.76	3.47	3.7
Homer	Short-horn	Nov. 25, '85	1,310	1.91	3,827	3,983	1.58	4.98	5.17
Holt	Short-horn	Dec. 17, '85	1,160	1.75	3,148	3,613	1.56	4.14	4.75

The present bulletin gives the results for the seven months ending Oct. 10, 1887.

Months, 1887.	Number of period.	Daily ration. Pounds.		Total food consumed. Pounds.	Weights and gains. Pounds.			
		Grain.	Hay.		Weight at beginning of period.	Weight at close of period.	Gain for period.	Gain per day.
Holstein steer, Beltz:								
March 10 to April 10	11	9.5	10.	990	1,080	1,130	50	1.67
May 10	12	9.8	12.6	763	1,130	1,170	40	1.34
June 10	13	8.23	7.4	481	1,170	1,200	30	1.
July 10	14	9.07	3.2	368	1,200	1,268	68	2.2
August 10	15	10.67	7.27	538	1,268	1,300	32	1.06
September 10	16	11.	13.43	733	1,300	1,320	20	.67
October 10	17	11.02	11.43	679	1,320	1,406	86	2.86
Holstein, Nicholas:								
March 10 to April 10	13	8.	8.9	927	760	810	50	1.67
May 10	14	7.3	11.7	662	810	866	56	1.86
June 10	15	5.87	4.73	334	866	912	46	1.5
July 10	16	5.47	2.07	226	912	950	38	1.2
August 10	17	8.23	5.17	402	950	1,000	50	1.67
September 10	18	9.2	11.43	619	1,000	1,058	58	1.93
October 10	19	9.47	10.07	586	1,058	1,126	68	2.27
Galloway steer, King Jumbo:								
March 10 to April 10	14	7.	7.9	867	746	810	64	2.13
May 10	15	7.3	9.3	592	810	850	40	1.34
June 10	16	3.9	2.87	219	850	879	29	.97
July 10	17	5.53	1.17	201	879	942	63	2.1
August 10	18	7.7	3.4	333	942	985	43	1.43
September 10	19	8.63	10.87	584	985	1,040	55	1.83
October 10	20	7.37	6.07	403	1,040	1,050	10	.34
Galloway steer, Judge:								
March 10 to April 10	10	8.	8.9	927	960	974	14	.47
May 10	11	8.8	11.3	697	974	1,040	66	2.2
June 10	12	4.7	3.87	270	1,040	1,076	36	1.2
July 10	13	5.6	1.77	221	1,076	1,123	47	1.54
August 10	14	8.7	4.53	397	1,123	1,140	17	.57
September 10	15	10.07	13.6	710	1,140	1,208	68	2.27
October 10	16	10.17	10.43	618	1,208	1,266	58	1.93
Hereford steer, Hendricks:								
March 10 to April 10	10	7.	8.	870	874	890	16	.5
May 10	11	7.1	10.2	611	890	920	30	1.
June 10	12	3.87	4.67	272	920	940	20	.67
July 10	13	3.9	2.7	198	940	1,010	70	2.34
August 10	14	5.8	4.6	312	1,010	1,030	20	.67
September 10	15	7.67	11.87	586	1,030	1,062	32	1.07
October 10	16	7.93	9.	508	1,062	1,100	38	1.27

Months, 1887.	Number of period.	Daily ration. Pounds.		Total food consumed. Pounds.	Weights and gains. Pounds.			
		Grain.	Hay.		Weight at beginning of period.	Weight at close of period.	Gain for period.	Gain per day.
Short Horn Steer, Homer:								
March 10 to April 10	15	8.5	8.9	942	1,052	1,072	20	.67
May 10	16	8.8	12.2	723	1,072	1,120	48	1.6
June 10	17	6.6	5.37	389	1,120	1,128	8	.27
July 10	18	7.34	2.73	302	1,128	1,170	42	1.4
August 10	19	10.07	5.37	463	1,170	1,209	39	1.3
September 10	20	10.03	12.03	662	1,209	1,242	33	1.1
October 10	21	10.47	10.5	629	1,242	1,310	68	2.27
Short Horn Steer, Holt:								
March 10 to April 10	15	8.	8.9	927	914	920	6	.2
May 10	16	8.1	11.2	673	920	970	50	1.67
June 10	17	2.89	3.87	219	970	988	18	.6
July 10	18	4.27	1.87	184	988	1,060	72	2.4
August 10	19	7.8	4.7	375	1,060	1,090	30	1.
September 10	20	8.13	13.3	643	1,090	1,106	16	.53
October 10	21	8.8	10.4	576	1,106	1,160	54	1.8
Devon Steer, Latitude:								
March 10 to April 10	9	5.5	7.	735	500	550	50	1.67
May 10	10	5.6	9.	530	550	580	30	1.
June 10	11	4.97	5.27	339	580	630	50	1.67
July 10	12	5.77	1.57	220	630	688	58	1.9
August 10	13	6.7	2.13	277	688	696	8	.27
September	14	7.23	10.	517	696	774	78	2.6
October 10	15	6.8	7.73	436	774	820	46	1.53
Jersey Steer, Roscoe:								
March 10 to April 10	14	8.5	8.9	867	870	900	30	1.
May 10	15	8.5	11.5	690	900	938	38	1.27
June 10	16	5.53	4.57	307	938	950	12	.4
July 10	17	5.43	1.93	221	950	1,004	54	1.8
August 10	18	7.57	4.4	359	1,004	1,010	6	.2
September 10	19	7.8	9.4	516	1,010	1,004	lost 6	......
October 10	20	7.8	8.1	477	1,004	1,046	42	1.4
Jersey Steer, Potter:								
March 10 to April 10	10	5.5	7.	645	588	628	40	1.34
May 10	11	5.7	8.6	485	628	660	32	1.07
June 10	12	3.5	3.23	218	660	720	60	2.
July 10	13	5.4	1.43	205	720	802	82	2.7
August 10	14	7.17	3.34	315	802	800	lost 2	......
September 10	15	7.4	11.07	567	800	860	60	2.
October 10	16	7.97	9.83	534	860	925	65	2.17

Since the date of the last bulletin, the steers have been allowed to run in a small field adjoining the experimental barn, in suitable weather; but have been taken up regularly three times a day and fed a meal and hay ration. When kept in stalls they have been watered regularly three times daily, and when outside have had free access to the water tanks. During the early part of the season they had a fair bite of grass; but in the long continued drouth later, they were entirely dependent on the food supplied in the stalls. No account has been made of the pasture, as all had an equal chance in that respect.

In April and May the steers had a small daily ration of ensilage or roots, from 5 to 8 pounds. The meal fed was made up of one-third oats and corn ground half and half, one-third wheat bran and one-third oil meal, from April to Aug. 24. Since that date the proportions have been 50 pounds corn and oats, 10 pounds calf meal and 30 pounds wheat bran.

Some of the animals have made greater gains than were looked for, others have failed to reach the weights expected.

It should be remembered that the animals were not selected on account of any phenomenal development; but the object was to get good *average animals* of the various breeds, feed and care for them well and *exactly alike*, save in amount of food, and see how they would respond in growth and flesh. Their answers are given in the following tables which I trust will prove of interest to cattle men.

I very greatly regret that we have had but one specimen of the Hereford and Devon breeds; but circumstances beyond our control prevented our securing them for this purpose.

The State Board of Agriculture are in hearty sympathy with this line of work, and we propose to secure another lot of calves during the coming summer for another test. Any parties having well bred and promising calves that they would like to have fed in this way are requested to write me.

While this single test with a limited number of animals does not positively demonstrate the value of the breeds; it is still hoped that the work is in the right direction and that a number of tests of this sort may lead to a more perfect knowledge of the feeding quality and habits of growth of the different breeds, which will be of real practical value to all breeders of cattle.

It is our intention to continue the feeding of these steers for another year, when the final results may be compared. Copies of this bulletin and No. 24 will be mailed to interested parties on application to the undersigned.

SAM'L JOHNSON,
Prof. of Agriculture.

FARM DEPARTMENT,
Agricultural College, Nov 1, 1887.

MICHIGAN STATE AGRICULTURAL SOCIETY.

PROCEEDINGS AND AWARDS FOR THE YEAR 1887.

OFFICERS.

President—WM. CHAMBERLAIN, Three Oaks.
Treasurer—A. J. DEAN, Adrian.
Secretary—J. C. STERLING, Monroe.

EXECUTIVE COMMITTEE.

Terms expire January, 1889.

Wm. Ball, Hamburg, Livingston Co.
Jno. C. Sharp, Jackson, Jackson Co.
A. O. Hyde, Marshall, Calhoun Co.
W. H. Cobb, Kalamazoo, Kalamazoo Co.
E. W. Rising, Davison Station, Genesee Co.
I. H. Butterfield, Lapeer, Lapeer Co.
John Lessiter, Jersey, Oakland Co.
James M. Turner, Lansing, Ingham Co.
J. P. Shoemaker, Amsden, Montcalm Co.
F. Hart Smith, Hillsdale, Hillsdale Co.

Terms expire January, 1888.

Abel Angel, Bradley, Allegan Co.
D. W. Howard, Pentwater, Oceana Co.
H. O. Hanford, Plymouth, Wayne Co.
F. L. Reed, Olivet, Eaton Co.
A. F. Wood, Mason, Ingham Co.
Franklin Wells, Constantine, St. Jos. Co.
J. Q. A. Burrington, Tuscola, Tuscola Co.
M. P. Anderson, Midland City, Midland Co.
John Gilbert, Ypsilanti, Washtenaw Co.
C. W. Young, Paw Paw, Van Buren Co.

EX-PRESIDENTS.

M. Shoemaker, Jackson, Jackson Co.
W. J. Baxter, Jonesville, Hillsdale Co.
Charles Kipp, St. Johns, Clinton Co.
E.O.Humphrey, Kalamazoo,Kalamazoo Co
W. L. Webber, East Saginaw, Saginaw Co.
Geo. W. Phillips, Romeo, Macomb Co.
Henry Fralick, Grand Rapids, Kent Co.
Philo Parsons, Detroit, Wayne Co.

STANDING COMMITTEES.

Business Committee.—A. O. Hyde, Marshall; J. C. Sharp, Jackson; Franklin Wells, Constantine.

Transportation Committee.—J. M. Turner, Lansing; Wm. Ball, Hamburg; M. Shoemaker, Jackson.

Committee on Finance.—M. P. Anderson, Midland; Franklin Wells, Constantine; D. W. Howard, Pentwater.

Committee on Premiums.—Wm. Ball, Hamburg; Geo. W. Phillips, Romeo; W. J. Baxter, Jonesville; I. H. Butterfield, Lapeer; C. W. Young, Paw Paw; James M. Turner, Lansing; J. P. Shoemaker, Amsden.

Committee on Rules.—H. O. Hanford, Plymouth; W. H. Cobb, Kalamazoo; John Lessiter, Jersey.

Committee on Reception.—E. O. Humphrey, Kalamazoo; M. Shoemaker, Jackson; Philo Parsons, Detroit.

Committee on Programme.—Geo. W. Phillips, Romeo; I. H. Butterfield, Lapeer; A. O. Hyde, Marshall.

Committee on Printing and Advertising.—A. J. Dean, Adrian; J. C. Sterling, Monroe; J. C. Sharp, Jackson.

General Superintendent.—H. O. Hanford.

Chief Marshal.—A. O. Hyde.

EXECUTIVE SUPERINTENDENTS.

Cattle—I. H. Butterfield.
Horses—G. W. Phillips.
Sheep—D. W. Howard.
Swine—John Lessiter.
Poultry—J. Q. A. Burrington.
Miscellaneous—Franklin Wells.
Fine Arts—W. J. Baxter.
Music—M. P. Anderson.
Children's Department—M. P. Anderson.
Needle Work—M. P. Anderson.
Manufactures—Henry Fralick.
Agricultural—Amos F. Wood.
Machinery—John Gilbert.
Farm Implements—Charles W. Young, Abel Angel and H. O. Hanford.
Dairy—J. P. Shoemaker.
Vehicles—F. L. Reed.
Bees, Honey, etc.—F. H. Smith.
Forage—E. W. Rising.
Gates and Gatekeepers—Wm. Ball.
Police—W. H. Cobb.

PROCEEDINGS OF THE EXECUTIVE COMMITTEE—WINTER MEETING.

FIRST DAY.

Michigan Exchange, Detroit,
January 10, 1887.

The regular annual meeting of the Executive Committee opened in the parlors of the Michigan Exchange, in the city of Detroit, this evening, the President, the Hon. William Chamberlain, in the chair.

The roll was called, and the following members answered to their names:

President Chamberlain, Messrs. Hanford, Lessiter, Sharp, Hyde, Reed, Burrington, Wood, Turner, Shoemaker, J. P. Angel, Howard, Young, Butterfield, Anderson, Phillips, Parsons and the Secretary.

The President then read his address as follows:

PRESIDENT CHAMBERLAIN'S ADDRESS.

Gentlemen of the Executive Committee of the State Agricultural Society:

We are convened in our regular winter session to consider the needs of the Society, and devise ways and means to promote its future usefulness. At the last winter meeting it was decided that the time had come when the Society should have a permanent location for holding its annual Fairs. A committee of five was selected to take the necessary steps toward securing this location. The committee received proposals from Detroit, Lansing, Jackson, and Kalamazoo, offering to donate land and money provided the Fair should be located permanently at some one of these places. Such favorable offers were made by Jackson and Lansing I deemed it advisable to call the Executive Committee together to consider the propositions, so that if possible a permanent location might be selected by you in time for holding the last Fair. The report of the committee was presented to you without recommendation from the fact that, on examination of Article Five of the constitution under which the Society was organized, it was found that the Executive Committee had no power to permanently locate the Fair. A vote was, however, taken on the two propositions to see if a choice could be reached, but neither proposition received a majority and no choice was indicated. While we thus failed to secure the object sought, the fact was demonstrated that the permanent location of the Fair is considered of sufficient importance to induce several cities of the State to offer substantial aid to secure its permanent location, and had we not been barred by the article referred to, I think the question would have been decided at that meeting.

The necessity of securing a permanent location for the Fair still exists, and I recommend that steps be taken immediately to secure such legislation as may be needed to empower the Society, through its Executive Committee, to locate permanently the place for holding its annual Fairs. When this power is secured, which it is believed is of vital importance to the Society, the question will present itself squarely before us: How shall the Society secure the funds necessary to place it on a safe financial basis, and what policy shall it adopt to sustain its present position among the leading agricultural societies of the country, and continue to be the State Agricultural Society, recognized as such by the people of the State, and holding its proper place among the other agricultural societies of the State? Other societies have been organized and pushed forward by the enterprise of those having them in charge until they are not only strong competitors with each other, but strive to rival even the State Society. And during the past few years, when the State Fair has been held at any one of the places selected, a disposition has been shown by some to carry the idea that it was a local fair, held simply to benefit the place where located, rather than the people at large. The Society early adopted a liberal policy towards its exhibitors, and has continued to pay liberal premiums, and furnish every facility necessary or possible to encourage agriculture and its kindred arts throughout the State. But this liberal policy and the expense of holding fairs from place to place have been too expensive, and we find our reserve fund nearly exhausted with our annual expenditures in excess of the receipts. Ohio, Indiana, Illinois, Iowa, Kansas, Nebraska, Minnesota, and other States, appreciating the value of their State agricultural societies, in the development and stimulation of agriculture, horticulture and manufacturing, have by State aid furnished the means to enable their societies to locate permanently on land with suitable buildings for their great annual exhibitions.

Michigan is not usually behind her sister States in progress and enterprise, when her Legislature is called upon to aid in any worthy object, and if there is a State pride in our Agricultural College, as I am sure there is, I believe there would be a hearty response on the part of the Legislature to aid this Society in permanently locating its Fairs, and providing the means to render certain a continuance of its present high rank among other State societies.

I recommend that a committee be appointed at this meeting to consider the matter of securing State aid, and to take the necessary steps in that direction.

The committee appointed to locate the Fair for 1886, decided to accept the proposition of the city of Jackson to furnish the use of the Jackson county fair ground enlarged and graded, with the buildings, sheds, stalls and pens then on the ground put in good order, and remove the buildings, stalls, sheds and pens owned by the State Society from Kalamazoo to Jackson, and erect the same on the Jackson grounds; to furnish a supply of water, and put everything in good shape ready for use one week previous to the opening of the Fair. Owing to delay on the part of the Jackson committee, however, this work was not completed until the stock began to pour in upon us, causing great confusion in the horse and cattle departments, much to the annoyance of exhibitors and the superintendents in charge. The demand was so great that a large number of additional stalls had to be provided for at considerable expense at a late day. I am under obligation to Superintendents Phillips and Butterfield for their forbearance and good nature during this trying time, and I hope such an emergency may not occur again. In this case, it would not, if we had been ready when the Fair opened. The Secretary should have the number of every stall, shed and pen, and when all are taken, close the entries.

The Fair opened on Monday, and Tuesday night found everything in good running order, with every prospect of success. The exhibits in every department were good, and in the Stock Department they were remarkably fine. The entries were large, notwithstanding they were confined to Michigan alone, a policy not always wise in my opinion, but eminently so now when the dreaded cattle disease is so prevalent and destructive beyond our borders. I am happy to say it has not as yet found its way into the herds of our State, and every precaution should be taken to prevent its doing so.

The heavy rain storm on Thursday was a serious blow to the Society, and the deficiency in the receipts is undoubtedly attributable to the rain. Thursday has become the great day of our Fairs, and hundreds of people were kept away by the rain who would otherwise have come.

I am responsible for the military drill of Friday, the last day of the Fair. Thinking this would be an interesting feature in connection with the Fair, I tried at an early day to interest several wealthy gentlemen of the State in the matter, and get them to contribute towards raising a fund of one thousand dollars to be offered in four premiums to the best drilled companies, believing it would help the Society and encourage the military companies to greater proficiency. I did not succeed in securing the money in this way, the gentlemen asked being unwilling to contribute for this purpose. Capt. H. F. Hatch, of the Jackson Guard, then offered to raise the one thousand dollars for premiums and pay all expenses of the drill for one-half the receipts of the day. This proposition, after consultation with Mr. Hyde, chairman of the business committee, was agreed to, and whatever may be the opinion of the committee, I believe it was a wise thing to do, and would recommend that it be continued, under such arrangements as you may deem best for the Society.

Michigan ranks fourth among the other states of the Union in the matter of sheep and wool growing, and only California and Ohio produce more pounds of wool. The number of sheep reported sheared in 1885 was 2,575,000, producing 14,560,000 pounds of wool. This wool at the average price of 22 cents a pound would bring the producer $3,203,200. This Society has encouraged high breeding, of the best grades of sheep, but has, in my opinion, failed to encourage the producer in preparing and tying up his wool in the best style to bring the highest price in market. I recommend that instead of the premium on samples of wool, that liberal premiums be offered for the best fleeces of fine, medium and coarse wools, not less than two of each; and a special premium should be paid for the best style of preparing and tying up wool for the market. I am satisfied that a great loss is incurred by the growers of wool because proper care is not taken in preparing it more neatly for the market. Improvement in this direction is needed and would pay well.

I recommend that the dairy interest of the State be carefully considered, and that more encouragement be given to exhibitors in this department.

The State Horticultural Society has held its annual exhibitions with us for a number of years, much to the advantage of both societies, as I had supposed. Our Society paid to the Horticultural Society two thousand dollars last year to aid in its exhibition with us. I thought the exhibit in that department could not be excelled in Michigan or elsewhere, and it certainly should not be excelled with this liberal use of funds by our Society, and the high standing which the Horticultural Society has in the State. Yet, I am told on good authority, that the exhibits in the horticultural department of the West Michigan Fair at Grand Rapids last fall, was superior both in point of excellence and variety of exhibits to the display made in this department at our last Fair. I call attention to this matter for your consideration.

The Forage Department should in some way be made less expensive to the Society. Fifteen hundred dollars is too great an expense in this department; it cannot be avoided under the present system, but the system can and ought to be changed.

The Premium List needs a very careful revision at this meeting, and the expense acount should be reduced. It is not safe, in my judgment, for the Society to assume a total expense for the ensuing year greater than sixteen thousand dollars.

The Society has paid its Secretary an annual salary of one thousand dollars in addition to his hotel and traveling expenses, and the Treasurer has been allowed a book-keeper at a salary of four hundred dollars a year. It seems to me that the salary of the Secretary should be reduced to eight hundred dollars and the Treasurer should not receive more than one hundred dollars for a book-keeper. It also strikes me that too much money is paid out for printing. I recommend a full consideration of these subjects at this meeting. I am also of the opinion that too much money was expended last year for exhibits in the Art Department. This should receive careful attention.

The President's lunch room, which in the past has been a very popular place at certain hours each day of the Fair, and which was quite an expense to the Society, was discontinued at the last Fair by my request.

The usual number of complimentary tickets were issued by me, and 174 were issued to the crop reporters by the Secretary of State. I am not aware that any abuses were practiced in the use of "attendants' tickets." The number issued must necessarily be large, and if superintendents will use proper care, I think the present plan of issuing them is as good as any that could be devised. I would, however, amend the rule relating to tickets furnished to the renters of booths and privileges.

I renew the recommendation made last year that all the departments, except Stock and Agricultural Implements, be placed in charge of one superintendent, for the assigning of space to exhibitors up to the opening day of the Fair, then to be turned over to the superintendent in charge of the exhibits. This would be less expensive to the Society and more satisfactory to exhibitors.

The rules governing the management of the Fair were generally well observed, and the best order was preserved on the grounds. In one instance only, was force required to preserve order, and that was in the afternoon of the last day of the Fair.

As the Executive Committee was called together at Jackson in May, it was decided to postpone the annual visit to the Agricultural College in June last. These visits heretofore have been very pleasant to the Committee, and I believe, profitable both to the College and the Society. We are under obligations to the State Board of Agriculture and the officers of the Agricultural College for the fine exhibits they have furnished our Fair from the Agricultural farm, free from any expense to the Society. We appreciate their efforts in our behalf, and trust they may have their reward.

This Society, under the contract made with the Jackson County Agricultural Society, have the privilege of holding the Fair on the Jackson grounds this year free of charge, if you elect to do so. I think it would be well if a decision could be reached at this meeting where the Fair should be held.

I am under obligations personally to each and all of you, gentlemen, for the efficient aid you have given me, and for the skill you have shown in the management of your respective departments, and thanking you for the honor the Society has conferred upon me in electing me for a second term as President, and hoping the year 1887 will be a more prosperous one for the Society generally, I am ready to assume the duties pertaining to the Chair.

The Secretary then read his report as follows:

SECRETARY'S REPORT.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—I have the honor to submit the following report of the transactions of the Secretary's office during the year 1886:

Two hundred and eighty-six business orders, amounting to $15,019.98, were drawn upon Treasurer Dean for the payment of accounts audited by the Business Committee. The detail of the general expenditures for which the above orders were issued has been classified and arranged under the proper heads, and will be reported by the Business Committee. A record of the same will also be found in the Secretary's register of accounts for the year, and the vouchers corresponding with the orders are on file in the Secretary's office.

Four hundred and eighty-one checks, amounting to $11,168.50, were issued for the payment of premiums awarded at the Thirty-eighth Annual Fair. A full and detailed statement of the same will be found in the accompanying schedule.

Three premiums awarded to horses in Classes 15 and 19 were protested. These premiums amounted to $150.00, and upon final adjustment this sum will have to be added to the amount of premium checks already issued, making the total for premiums awarded $11,318.50.

The Horticultural Department, under the supervision of the State Horticultural Society, awarded premiums to the amount of $800.00. Checks were drawn upon Treasurer Dean for the payment of the same.

The following table exhibits the amount of cash premiums offered and awarded in each division; also the number of diplomas and medals offered and awarded:

CASH PREMIUMS.

Division.	Offered.	Awarded.
A—Cattle	$3,535 00	$3,283 00
B—Horses	3,874 00	3,313 00
C—Sheep	1,588 00	1,451 00
D—Swine	701 00	620 00
E—Poultry	365 00	312 00
F—Farm products	605 00	528 00
G—Dairy products	210 00	149 00
H—Bees, honey, etc	302 00	296 00
I—Farm implements	----------	----------
J—Vehicles	----------	----------
K—Machinery	----------	----------
L—Manufactured Goods	573 00	251 00
M—Musical and other instruments	23 00	----------
N—Art	935 00	781 00
O—Needlework	325 50	244 50
P—Miscellaneous	113 00	82 00
Q—Children's department	50 50	8 00
	$13,200 00	$11,318 50
Horticultural Department	800 00	800 00
Total	$14,000 00	$12,118 50

MEDALS AND DIPLOMAS.

Division.	Diplomas.		Medals.	
	Offered.	Awarded.	Offered.	Awarded.
D—Swine	5	5		
L—Manufactured goods	1		1	
M—Surgical instruments, etc	7			
N—Art	1			
O—Needlework	2			
P—Miscellaneous	2	2	2	
Total	18	7	3	

The following is a list of entries in each class and division:

DIVISION A—CATTLE.

Class.	Entries.	
1—Shorthorns	207	
2—Devons	45	
3—Herefords	98	
4—Jerseys	134	
5—Galloway and Polled Angus	60	
6—Holstein-Friesians	158	
7—Grades	42	
8—Fat Cattle	39	
N. E. Ayrshires	13	
Total		786

DIVISION B—HORSES.

9—Cleveland Bays	14	
10—Thoroughbreds	16	
11—All Work	153	
12—Roadsters	39	
13—Breeders' Stock	74	
14—Gent's Driving Horses	24	
15—Clydesdale and English Draft Horses	19	
16—Norman Percheron and other Truck Horses	48	
17—Draft Horses	33	
18—Carriage and Buggy Horses	45	
19—Roadster Stallions	31	
20—Roadster Mares and Geldings	30	
21—Horses under Saddle	10	
22—Sweepstakes Stallion and six of his get	15	
Total		551

DIVISION C—SHEEP.

23—Thoroughbred American Merinos	117	
24—Thoroughbred American Merinos bred in Michigan	105	
25—Fine Wool Grades	44	
26—Southdowns	39	
27—All Middle Wool Sheep other than Southdowns	60	
28—All Middle Wool Sheep other than Southdowns bred in Michigan	74	
29—Leicester	23	
30—Cotswold and other Long-Wooled Sheep	52	
31—Grade Coarse-Wooled Ewes	20	
32—Fat Sheep	34	
Total		568

DIVISION D—SWINE.

33—Berkshire	17	
Essex	59	
Suffolk and Small Yorkshire	45	
Poland China	98	
Chester White and other Large Breeds	80	
Fat Hogs	18	
Total		317

DIVISION E—POULTRY.

Class.		Entries.
34—Poultry		749

DIVISION F—FARM PRODUCTS.

35—Grain and Seeds	197	
36—Roots and Vegetables	290	
37—Display Roots and Vegetables	7	
38—Flour, Meal and Feed	30	
Total		524

DIVISION G—DAIRY PRODUCTS.

39—Butter, Cheese and Dairy Articles	52	
40—Sugar, Bread and Pickles	46	
41—Soap, Prepared Groceries, etc	2	
Total		100

DIVISION H—BEES, HONEY, ETC.

42—Bees, Honey, etc		79

DIVISION I—FARM IMPLEMENTS.

43—Plows	72	
44—Tillage Implements	79	
45—Seed Drills, Sowers, Planters, etc	36	
46—Haying and Harvesting Implements	110	
47—Apparatus for cleaning and Preparing Crops	41	
48—Miscellaneous Farm Articles	54	
Total		392

DIVISION J—VEHICLES.

49—Vehicles		238

DIVISION K—MACHINERY.

50—Machinery for Working upon Wood and Metals	421	
51—Miscellaneous Machinery	4	
Total		425

DIVISION L—MANUFACTURED GOODS.

52—Material	18	
53—Factory Made Goods	6	
54—Articles of Dress	2	
55—Articles of Leather and India Rubber	33	
56—Furniture	68	
57—Stoves, Iron and Concrete Work	13	
Total		140

DIVISION M—MUSICAL INSTRUMENTS, ETC.

58—Musical Instruments and Sewing Machines	21	
59—Surgical and other Instruments	3	
60—Clocks, Jewelry, etc	--	
Total		24

DIVISION N—ART.

61—Painting, Sculpture, etc., by professionals	198	
62—Painting and Drawing, by amateurs	178	
Total		376

DIVISION O—NEEDLE AND FANCY WORK.

63—Articles of Ladies' Dress	24	
64—Plain Needle and Machine Work	93	
65—Embroidery and Ornamental Needle Work	333	
66—Crochet, Knit and Fancy Work	181	
67—Hair, Shell and Wax Work	49	
Total		680

DIVISION P—MISCELLANEOUS.

68—Miscellaneous Articles	58	
69—Household Articles	29	
70—Printing and Stationery	21	
Total		108

DIVISION Q—CHILDREN'S DEPARTMENT.

Children's Work		35

HORTICULTURAL DEPARTMENT.	Entries.
Fruits and Flowers	1,007
Total Entries	7,159

The following moneys coming into my hands as Secretary of the Society, through the sources named, have been paid over to the Treasurer and his receipt taken for the same:

From Annual Memberships	$752 00
" Rent of Stalls and Pens	477 75
	$1 229 75

Since the last annual meeting of this Committee, Articles of Association of the following named societies have been filed in this office: "Lake View Mutual Agricultural Society," "Berrien County Agricultural Society," "Clinton County Agricultural Society," "Mecosta County Agricultural Society," "Montmorency Agricultural and Mechanical Society," "Bingham Township Agricultural, Horticultural and Art Association," "Antrim County Agricultural Society," "Arenac County Agricultural Society," "Chippewa County Agricultural Society," "Clare County Agricultural Society," "Fenton District Fair Association," "Grange Agricultural Society," "Houghton Agricultural and Driving Park Association," "Bingham Agricultural Society," "Cedar Springs Union Agricultural Society," "Hadley District Fair Association," "Armada Agricultural Society," "Manistee County Agricultural Society," "Fremont Agricultural and Driving Park Association," "Avon Agricultural Society," "Hesperia Agricultural and Driving Park Association." "Otsego County Agricultural and Mechanical Society." South Ottawa and West Allegan Agricultural Society," "Northeastern Agricultural Society," "South Huron and North Sanilac Agricultural Society," "Caro District Agricultural Society," "Wyandotte Agricultural Society."

INVENTORY OF PROPERTY IN THE SECRETARY'S OFFICE

American Shorthorn Herd Book	29 vols.
American Jersey Cattle Club Herd Register	16 "
American Devon Herd Book	5 "
Dutch Friesian Herd Book	3 "
Holstein Herd Book	8 "
North American Galloway Herd Book	2 "
Pedigrees of English Shorthorn Bulls	1 "
American Stud Book (Bruce)	3 "
American Berkshire Record	4 "
Vermont Merino Sheep Register	1 "
Michigan Farmer for years 1845 to 1854	8 "

Agricultural reports of Michigan, Ohio, Indiana, Illinois, Massachusetts, Connecticut, Maine, Iowa, Kansas, Missouri, New Hampshire, California, Upper Canada, Department of Agriculture and the Michigan State Horticultural Society Report.

1 Office Desk.
1 Society seal.
1 Gold medal.
6 Inkstands.
2 Bill files.
2 Letter files.
1 Postal scale.
1 Pair shears.
15 Spindles.
5 Boxes for Books.

J. C. STERLING,
Secretary.

Accepted and referred to Finance Committee.

Chairman Hyde of the Business Committee submitted the Report of the Committee as follows:

STATEMENT OF BUSINESS COMMITTEE IN DETAIL.

EXPENSES OF WINTER MEETING.

1886.	No.	Order.	
Jan. 14.	3	A. F. Wood, expenses	$3 75
	4	John Gilbert, "	2 25
	5	E. O. Humphrey, "	4 35
	6	Wm. Ball, "	3 50
	7	John Lessiter, "	2 50
	8	C. W. Young, "	6 80
	9	Wm. Chamberlain, "	8 10
	10	J.Q.A. Burrington, "	6 20
	11	E. W. Rising, "	4 50
	12	Franklin Wells, "	10 30
	13	I. H. Butterfield, "	3 60
	14	M. P. Anderson, "	4 84
	15	Geo. W. Phillips, "	5 00
	16	Henry Fralick, "	4 75
	17	J. P. Shoemaker, "	8 65
	18	Abel Angel, "	8 75
	19	M. J. Gard, "	8 55
	20	J. C. Sharp, "	3 30
	21	D. W. Howard, "	11 85
	22	H. O. Hanford, "	3 15
	23	F. L. Reed, "	8 10
	24	A. O. Hyde, "	8 25
	25	W. H. Cobb, "	6 80
	26	A. J. Dean, "	2 50
Feb. 18.	28	Russell House, board of Committee	247 01
Mar. 8.	30	Detroit Free Press, printing journal and 300 bound copies	116 50
April 16.	31	American Express Co., express on books and papers	4 15
	32	J. C. Sterling, expense attending	3 74
	33	F. D. Hamilton, printing notices and stationery	5 25
			$516 99

PRESIDENT'S OFFICE.

Sept. 28.	194	Wm. Chamberlain, expenses of President	$58 55

HERD BOOKS.

April 16.	35	Am. Short Horn Association 29th Vol. A. S. H. B.	$5 45

SECRETARY'S OFFICE.

Jan. 14.	1	J. C. Sterling, 3 months' salary	$250 00
April 16.	41	J. C. Sterling, 3 months' salary	250 00
June 29.	71	J. C. Sterling, 3 months' salary	250 00
Sept. 25.	123	J. E. Landon, assistant secretary	33 60
	124	Geo. E. Smith, assistant secretary	36 00
Sept. 27	125	C. J. Phillips, assistant secretary	33 60
	126	J. H. Hanford, assistant secretary	12 40
	127	A. E. Wing, assistant secretary	26 30
	128	F. Livermore, assistant secretary	13 00
	129	L. H. Ives, assistant secretary	11 75
	130	R. Reiley, assistant secretary	9 00
	131	W. K. West, assistant secretary	26 10
	132	Mrs. Chapin, board of clerks	46 00
	133	J. E. Casebeer, board of Secretary and clerks	96 50
Oct. 1.	248	J. C. Sterling, 3 months' salary	250 00
	278	J. M. Sterling, rent of office for 1886	50 00
			$1,394 25

TREASURER'S OFFICE.

1886.	No.	Order.	
Sept. 28.	182	P. Risick, labor	$2 40
	190	Clark & Co., extra dinners	5 25
	192	Clark & Co., board Treasurer and assistants	60 25
	195	Mrs. Dettwiler, board of clerks	21 00
	196	Mrs. Chapin, board of clerks	17 00
	201	Pay-roll, clerk pay-roll	189 90
Dec. 1.	259	A. J. Dean, railroad fare, express, etc.	76 79
	260	A. J. Dean, Treasurer, book-keeper's salary	400 00
			$772 59

STORAGE.

June 29	67	J. B. and W. H. Cobb, storage of goods	$20 00

INTEREST.

April 16.	47	A. J. Dean, interest on Government bonds returned	$100 00

GENERAL EXPENSE ACCOUNT.

Jan. 13.	2	M. Craven, repairing pumps	$15 00
Feb. 4.	27	G. J. Remen, repairing faucets	1 00
June 29.	69	Hibbard House, board Business Committee and officers	16 25
29.	72	Wm. Chamberiain, trips to Jackson	19 90
Aug. 3.	83	Wm. Ball, expenses to Jackson	2 30
	84	W. H. Cobb, two trips to Jackson, postage, etc.	14 90
	86	Henry Fralick, expenses to Jackson	5 60
	87	Wm. Chamberlain, expenses to Jackson	18 55
	88	Hibbard House, board of Committee	16 25
Sept. 25.	107	J. B. Frost, map of ground	50 00
	109	W. H. Gilbert, express, tacks, telegraphing, etc.	12 66
27.	139	A. Strong, oil	1 32
27.	141	Clark & Co., board of Committee	66 95
	144	John Norris, cider barrel	1 50
	184	O. N. Hilton, Judge of election	5 25
	216	H. C. Ransom, use of chairs	2 25
	223	M. D, Derby, repairing pump	3 00
	228	W. U. Tel. Co., telegraphing	1 25
	234	Wm. Chamberlain, expenses to Jackson	10 60
	245	S. E. Graves, Judge of election	3 00
Dec. 14.	263	J. C. Sterling, expenses to Jackson	24 85
	274	Clark & Co., board Messrs. Hanford and Wells	2 00
	275	Seib & Boier, twine, tacks, etc.	2 97
	284	Wm. Chamberlain, expenses attending meeting	16 15
			$313 50

HORTICULTURAL SOCIETY.

Sept. 25.	92	S. M. Pearsall, Treasurer, allowance	$1,200 00

FORAGE.

1886.	No.	Order.	
Sept. 25.	95	Frank Maynard, hay and straw	$768 12
	116	J. C. Sharp, hay and straw	785 57
28.	156	E. W. Rising, Superintendent's pay-roll	54 00
	179	E. W. Rising, Superintendent's expenses	28 25
	180	E, W. Rising, Superintendent's expenses	30 00
	187	James Clark, pasturage of cattle	2 50
			$1,668 44

LIVERY ACCOUNT.

Aug. 3.	78	C. H. Vandercook, livery for Business Committee	$10 00
Sept. 28.	160	Knapp & Sutton, carriage for plumber	1 00
	189	Knapp & Sutton, carriage, saddle horse, etc.	43 50
			$54 50

EXPRESS ACCOUNT.

Aug. 3.	81	U. S. Express Co., express on stationery	$4 40
	271	Express Co., sundry charges	21 44
			$25 84

BUILDING ACCOUNT.

1886.	No.	Order.	
Sept. 25.	89	J. C. Riley, 168 horse stalls @ $1.50, and repairing	$243 59
	93	Frank Davis, numbering stalls	10 85
	102	Frank Maynard, numbers for stalls	10 00
	105	W. H. Gilbert, pay-roll	76 39
	110	Pay-roll, labor	15 33
	113	A. & H. Wilcox, lime	2 00
	114	E. T. Webb, paint	4 55
	118	Pay-roll, labor	37 00
	119	Geo. B. Frost, labor	46 00
	137	J. E. Kennedy, painting Horticultural Hall	39 50
28.	163	Pay roll, flooring pens	38 79
	183	C. C. Pond. lumber	3 48
	220	D. S. Smith, work on President and Secretary's office	64 26
Oct. 13.	249	A. Graves, numbers for stalls	14 44
			$606 18

SAWDUST.

Sept. 28.	218	Jackson & Filley, 13 loads	$9 79
	222	L. L. Carey, 5 loads	2 50
			$12 25

LUMBER.

Sept. 25.	101	C. C. Pond & Co., lumber bill	$555 39

HARDWARE.

Sept. 28.	214	C. L. Pierce, hardware bill	$42 81
	215	O. H. McConnell, hardware bill	5 03
	217	Warner & Dodge, hardware bill	91 91
			$139 75

PERMANENT LOCATION.

1886.	No.	Order.	
Mar. 8.	29	Russell House, board of committee	$29 25
Apr. 16.	36	E. O. Humphrey. expense attending meeting	10 30

PERMANENT LOCATION—*Continued.*

1866.	No.	Order.	
April 16.	37	Hibbard House, board of committee	$16 75
	38	Russell House, beard of committee	11 25
	39	Hudson House, board of committee	10 50
	40	Hibbard House, board of committee	57 25
	42	Wm. Chamberlain, expense attending meeting	35 00
	43	William Ball, expenses	11 35
	44	M. Shoemaker, “	12 55
	45	W. H. Cobb, “	10 50
	46	J. P. Shoemaker, “	6 15
	48	F. L. Reed, “	5 50
	49	Henry Fralick, “	2 80
	50	D. W. Howard, “	11 30
	51	E. W. Rising, “	8 30
	52	A. F. Wood, “	1 50
	53	Abel Angel, “	4 85
	54	M. J. Gard, “	6 00
	55	H. O. Hanford, “	3 65
	56	C. W. Young, “	3 75
	57	John Gilbert, “	1 50
	58	Franklin Wells, “	5 00
	59	Philo Parsons, “	4 60
	60	John Sharp, “	4 80
May 3.	61	M. P. Anderson, expenses	10 30
Sept. 28.	185	J. Q. A. Burrington	10 30
Dec. 14.	261	J. C. Sterling, “	10 35
	268	W. L. Webber, “	4 77
			$310 12

BAND.

Sept. 25.	120	Ypsilanti city Band, four days	$115 00

GROUNDS.

Sept. 25.	122	N. W. Burkhart, moving building	$50 00
28.	209	B. J. Woods, labor	10 57
	212	Pay-roll, clearing up after Fair	32 29
	199	R. E. Emmons, team work	96 00
			$188 86

WATER.

Sept. 25.	97	Geo. H. Porter, pipe, fittings and labor	$127 15
28.	211	Geo. H. Porter, taking up pipe	6 50
			$133 65

BUSINESS COMMITTEE.

May 3.	62	J. C. Sharp, expenses to Kalamazoo	$5 10
June 29.	68	A. O. Hyde, sundry trips	19 10
July 6.	74	Hurd House, board of committee	8 00
Aug. 3.	79	A. O. Hyde, sundry trips to Jackson	8 45
	85	J. C. Sharp, expenses to Kalamazoo	7 75
Sept. 25.	104	Wm. Gilbert, expenses of clerk	8 40
	134	Mrs. Chapin, board clerk	12 50
27.	146	A. O. Hyde, sundry articles purchased	5 70
	147	A. O. Hyde, expenses of chairman	23 10
28.	202	H. O. Hanford, attending meetings at Jackson	4 80
	203	H. O. Hanford, attending meetings at Jackson	5 30
	219	John C. Sharp, personal expenses	13 00
	225	A. O. Hyde, expenses as chairman	5 65
	230	H. O. Hanford, expenses attending meetings	5 30

BUSINESS COMMITTEE—*Continued.*

1886.	No.	Order.	
Dec. 14.	273	Wm. H. Gilbert, clerk for committee	$202 80
	280	Clark & Co., board of committee	11 25
	285	H. O. Hanford, expenses meeting at Jackson	5 30
	286	A. O. Hyde, expenses meeting at Jackson	7 95
			$359 45

LOCATING COMMITTEE.

May 3.	63	H. O. Hanford, expenses to Kalamazoo	$9 55
	64	Wm. Chamberlain, expenses to Kalamazoo	9 10
	65	John Gilbert, expenses to Jackson	3 00
	66	Hurd House, board of committee	9 00
			$30 65

PRINTING AND ADVERTISING.

July 22.	75	M. D. Hamilton & Son, premium lists, entry blanks, etc.	$209 25
Aug. 3.	80	Calvert Lithograph Co., 3,100 complimentaries	19 35
	82	Geo. F. Payne, entry and committee books	60 25
Sept. 25.	135	M. D. Hamilton, blanks, etc.	18 70
28.	204	Calvert Lithograph Co., lithographs	83 75
	229	W. K. West, wrapping advertising matter	16 50
	231	Jas. O'Donell & Co., posters, programmes, etc.	62 50
	232	Carlton, & Van Antwerp, tickets, etc.	22 45
	233	Detroit Free Press, large posters	110 00
Oct. 18.	254	O. S. Gulley & Co., printing tickets	83 20
Dec. 1.	257	Gibbons Bros., printing awards in Farmer	75 00
14.	262	J. C. Sterling, expenses to Jackson and Detroit	10 65
	272	Democrat Printing Co., tags, envelopes, etc.	43 50
	283	Times and Expositor, letter heads, etc.	147 80
			$962 90

MEAL TICKETS.

Sept. 25.	90	Palmer & Reed, 10 @ 25c	$2 50
	91	First Baptist Church, 352	88 00
	94	Napoleon M. E. Church, 76	19 00
	96	B. Welch, 20	5 00
	100	Napoleon Baptist Church, 86	21 50
	103	H. H. Hudson, 51	12 75
	117	Mr. Perry, 4	1 00
	121	F. W. Baptist Church, 71	17 75
28.	208	B. J. Wood, 17	4 25
	213	W. A. Gilbert, 3	75
	224	First M. E. Church, 31	7 75
	226	First Baptist Church, 8	2 00
Oct. 13.	250	Cooper St. M. E. Church, 40	10 00
			$192 25

POWER.

Sept. 25.	99	C. Aultman & Co., line shaft power	$60 00
28.	191	Jno. Hutchinson, hall power, putting up shaft	200 00
			$260 00

POSTAGE.

1886.	No.	Order.	
April 16.	34	Postmaster at Detroit, stamps for Secretary's office	$6 00
June 29.	70	Postmaster at Detroit, stamps for Secretary's office	10 00
	73	Postmaster at Adrian, stamps for printing advertising	5 00
Aug. 3.	76	Postmaster at Detroit, stamps for premium lists	16 00
	77	Postmaster at Detroit, postal cards for Sec'y	5 00
Sept. 25.	106	Whitmore & Co., stamps for Business Committee	2 25
	136	Postmaster at Jackson, stamps for Secretary	5 00
28.	205	Postmaster at Adrian, stamps for Treasurer	5 00
Dec. 1.	258	Postmaster at Adrian, stamped envelopes	11 00
14.	264	Postmaster at Detroit, stamps for complimentaries	16 00
	265	Postmaster at Detroit, stamps for posters	18 00
	266	Postmaster at Detroit, stamps for premium lists	10 00
			$109 25

CHECK ROOM.

Sept. 25.	111	S. B. Hutchinson, clerk hire	$8 15

DECORATING.

Sept. 28.	148	E. A. Daily, painting signs	$2 50

GATES.

Sept. 28.	197	Mrs. Dettwiler, board of men	$32 00
	198	Mrs. Penny, board of men	30 00
	200	Pay-roll	75 10
	241	Wm. Ball, expenses of Superintendent	20 95
	242	Pay-roll, paid men	17 10
	243	Pay-roll, paid men	24 05
	244	Pay-roll, paid men	22 30
Oct. 28.	256	Wm. H. McAllister, night watch	14 00
			$235 50

RIBBONS AND BADGES.

Sept. 28.	206	Newcomb & Endicott, ribbons	$14 52

LADIES' COTTAGE.

Sept. 28.	210	Mrs. B. J. Wood, tending cottage	$15 00

SWITCHING.

Sept. 28.	221	M. C. R., switching 1 car	$1 00

STATIONERY.

Sept. 28.	227	G. D. Brown, paper, ink, etc.	$7 79
Dec. 14.	269	F. W. Meir, stationery	10 69
			$18 48

POSTING BILLS.

Sept. 28.	246	Chas. Van Ostrand, posting Adrian	$ 96
	270	Bill Poster, posting State Fair bills	43 61
			$44 57

POLICE.

1886.	No.	Order.	
Oct. 13.	251	Police pay-roll, day police	$249 85
	252	Police pay-roll, night police	127 25
Dec. 14.	279	J. C. Sharp, error in pay-roll	6 00
			$383 10

MEDALS AND DIPLOMAS.

Dec. 14.	276	Ira Mayhew & Co., filling diplomas	$1 75

MILITARY PRIZE DRILL.

Dec. 14.	281	A. J. Dean, Treasurer, one-half of gate money Friday	$2,524 12

BOOTHS AND SHOWS.

Dec. 14.	282	A. J. Dean, Treasurer, tickets used by Superintendent	$690 50

TRANSPORTATION COMMITTEE.

Sept. 28.	142	W. H. Cobb, board of Chairman	$14 50
	143	W. H. Cobb, expense of Chairman	30 50
			$45 00

MARSHAL'S OFFICE.

Sept. 28.	140	Clark & Co., board Marshal and assistants	$66 75
	145	A. O. Hyde, expense of assistants	61 95
			$128 70

HORSE DEPARTMENT.

Sept. 28.	157	A. E. Sutton, boarding horse	$1 00
	159	Geo. W. Phillips, expense Superintendent	26 50
	165	S. A. Colby, expense of Judge	8 55
	166	B. F. Proctor, expense of Judge	8 55
	167	R. W. Coykendall, expense of Judge	8 55
	168	H. F. Phillips, expense of Judge	9 00
	169	J. W. Parkhurst, expense of Umpire	5 35
	170	John Davidson, expense of Judge	8 80
	175	Wm. Sanderson, board of two horses	2 00
	176	Ed Price, board of one horse	1 00
	177	Wait & Fellows, board of one horse	1 00
	178	Geo. W. Phillips, jr., expenses and labor as assistant	27 50
	181	J. E. Woodruff, boarding horse	3 00
	186	A. E. Sutton, boarding horses	6 00
	188	A. E. Sutton, boarding horses	8 00
			$124 80

CATTLE DEPARTMENT.

Sept. 28.	151	I. H. Butterfield, jr., Superintendent's expenses	$47 60
	161	J. O. Curry, expense of Judge	25 00
	164	Peleg Winslow, expense of Judge	18 00

CATTLE DEPATMENT.—*Continued.*

1886.	No.	Order.	
Sept. 28.	173	F. W. Grenell, expense of Judge	$8 00
	174	L. C. Paine, expense of Judge	30 00
Oct. 18.	253	Richard Gibson, expense of Judge	17 25
			$145 85

SHEEP DEPARTMENT.

Sept. 28.	256	D. W. Howard, expense of Superintendent	$35 50
Dec. 14.	267	Mrs. Fuller, board of Judge	8 50
			$44 00

SWINE DEPARTMENT.

Sept. 28.	155	John Lessiter, Superintendent's expenses	$25 40
	172	F. W. Grenell, expense of Judge	12 00
			$37 40

POULTRY DEPARTMENT.

Sept. 28.	162	David Jones, expense of Judge	$20 00
	239	J. Q. A. Burrington, Superintendent's expenses	32 35
			$52 35

BEE AND HONEY DEPARTMENT.

Sept. 28.	152	M. J. Gard, Superintendent's expenses	$25 45

IMPLEMENT DEPARTMENT.

Sept. 28.	150	H. O. Hanford, Superintendent's expenses	$23 20
	153	C. W. Young, Superintendent's expenses	43 40
	171	C. W. Young, Superintendent's expenses	5 00
Oct. 28,	255	Clark & Co., board Mr. Angel	12 50
			$84 10

MANUFACTURING DEPARTMENT.

Sept. 28.	238	H. S. Fralick, Ass't Superintendent's expenses	$29 70
	240	Henry Fralick, Superintendent's expenses	25 60
			$55 30

AGRICULTURAL DEPARTMENT.

Sept. 27.	138	J. E. Casebeer, board of Superintendent	$2 00
	149	A. F. Wood, Superintendent's expenses	28 05
			$30 05

VEHICLE DEPARTMENT.

Sept. 28.	247	F. L. Reed, Superintendent's expenses	$17 50

MISCELLANEOUS DEPARTMENT.

Sept. 28.	235	Franklin Wells, Superintendent's expenses	$29 55

MACHINERY DEPARTMENT.

Sept. 25.	108	John Gilbert, Superintendent's expenses	$7 50
	112	John Gilbert, railroad fare, etc	3 00
			$10 50

MUSIC DEPARTMENT.

1886.	No.	Order.	
Sept. 28.	237	M. P. Anderson, Superintendent's expense	$38 33

ART DEPARTMENT.

Sept. 28.	158	Foster Pratt, expense of Judge	$8 25
	207	Chas. Ward, labor	10 00
	277	A. J. Brow, nails, hooks, etc	2 45
			$20 70

NEEDLEWORK DEPARTMENT.

Sept. 25.	98	V. Bostwick, helping Superintendent	$1 12
	115	L. B. Parsons, expenses and labor as assistant	35 83
28.	193	Philo Parsons, Superintendent's expenses	21 90
			$58 85

DAIRY DEPARTMENT.

Sept. 28.	154	J. P. Shoemaker, Superintendent's expenses	$26 55

Summary Statement, 1886.

Winter meeting	$516 99
Herd books	5 45
Secretary's office	1,394 25
Storage	20 00
Interest	100 00
Livery	54 50
Express	25 84
General expense	313 50
Horticultural Society	1,200 00
Forage	1,668 44
Building	606 18
Sawdust	12 25
Lumber	555 39
Hardware	139 75
Grounds	188 86
Permanent location	310 12
Water	133 65
Band	115 00
Business Committee	359 45
Printing and advertising	962 90
Locating Committee	30 65
Meal tickets	192 25
Postage	109 25
Power	260 00
Check room	8 15
Decorating	2 50
Treasurer's office	772 59
Gates	235 50
Ribbons and badges	14 52
Ladies' cottage	15 00
Switching	1 00
Stationery	18 48
Posting bills	44 57
Police	383 10
Medals	1 75
Prize drill	2,524 12
Booths and shows	690 50
President	58 55
Transportation Committee	45 00
Marshal's office	128 70
Horse department	124 80
Sheep department	44 00
Cattle department	145 85
Swine department	37 40
Poultry department	52 35
Bee and Honey department	25 45
Implement department	84 10
Manufacturing department	55 30
Agricultural department	30 05
Vehicle department	17 50
Miscellaneous department	29 55
Machinery department	10 50
Music department	38 33
Art department	20 70
Needlework department	58 85
Dairy department	26 55
Total amount	$15,019 98

MONEY RECEIVED BY BUSINESS COMMITTEE FOR BOOTH RENTALS.

1886.	No.			Tickets issued.
Sept. 1.	1	Spicer & Hood	$48 00	24
	2	First M. E. Sunday School	48 00	24
	3	Cooper St. M.E.Church	80 00	40
	4	First Baptist Church	160 00	80
	5	Daniel Osband	40 00	20
	6	Joseph Hooker	24 00	12
	7	Free Will Bap. Church	96 00	48
	8	Daniel Harmon	25 00	--
2.	9	Napoleon G. A. R	80 00	40
	10	Napoleon Bap. Church	80 00	40
3.	11	M. Loemecker	40 00	20
4.	12	Wm. West	40 00	20
6.	13	Mrs. Wm. Neil	25 00	7
	14	C. E. Charles	75 00	37
7.	15	Frank G. Cress	18 00	9
	16	Palmer, Reed & Co	48 00	24
	17	Smith & Miller	40 00	20
	18	Palmer & Luce	80 00	40
	19	Moses Forsch	60 00	30
	20	Hickman & Bartlett	125 00	62
8.	21	Carroll & Boardman	80 00	40
	22	A. T. Stone	22 00	8
9.	23	Mrs. E. Hickman	29 00	14
	24	Brooks and Sprague	24 00	12
	25	Harry Tisdall	20 00	10
10.	26	Mrs. Flanigan	25 00	12
11.	27	Thos. Wilkinson	25 00	12
	28	Lang & Co	30 00	15
	29	Nye & Pritchard	35 00	17
	30	H. J. Curtis	36 00	18
	31	Henry Hague	15 00	7
	32	Chas. Poyer	18 00	9
	33	Maloney & Redmond	50 00	25
	34	Manlon Bros	32 50	12
	35	W. H. Stewart	18 00	9
13	36	Herman Andre	15 00	7
	37	L. Patten	25 00	12
	38	J. Beith & Co	50 00	25
	39	Mr. Green	25 00	12
	40	C. H. Hopson	14 00	7
	41	J. M. Albach	25 00	12
	42	J. M. Baker	24 00	12
	43	H. C. Palmer	5 00	2
	44	Thos. Perie	6 00	
	45	Carmer & Co	15 00	7
	46	Hickman & Hammon	27 50	13
	47	A. L. Hall	10 00	5
	48	J. N. Stone	10 00	5
	49	Frank Showerman	18 00	9
	50	Austin & Becket	10 00	5
	51	Keefe & Stohner	10 00	5
	52	E. O. Halsted	32 00	16
	53	S. Spartali	10 00	5
	54	J. J. Martin	24 00	12
	55	Peyton & Palmer	24 00	12
	56	Hoyt & Johnson	25 00	12
	57	Weaver & Knickerbocker	10 00	5
	58	M. R. Allen	28 00	14
	59	E. S. Pilbean	21 00	10
	60	A. A. Mintzer	10 00	5
	61	T. Davis	6 00	3
	62	S. J. Hasch	16 00	8
	63	G. W. Donaldson	150 00	75
	64	G. A. Ferguson	16 00	8
	65	Robt. Wright	40 00	20
14.	66	M. Lane	10 00	5
	67	S. Covert	10 00	5
	68	Frank Ehle	10 00	5
	69	M. Weinberger	8 00	4
	70	Andrew Miller	25 00	12
	71	J. H. Freed	12 00	6
	72	Geo. H. Hosner	30 00	14
	73	P. Frank	7 50	3
	74	P. Richardson	43 00	21
	75	John Nelson	10 00	5
	76	Manon Bros	9 00	--
	77	N. Cridell	10 00	5
	78	S. Cridell	10 00	5
	79	N. Skuller	10 00	5
	80	H. C. Culter	6 00	3
	81	Samuel Hagerman	6 00	3
	82	Jewitt Williams	20 00	10
	83	A. C. Vermet	10 00	5

MONEY FOR BOOTH RENTALS.—*Continuvd.*

1886.	No.			Tickets Issued.
Sept. 14.	84	H. L. Acley	$6 00	3
	85	C. G. Hampton	20 00	10
	86	Wm. Loranger	5 00	2
	87	S. McMillan	6 00	3
	88	C. McMillan	6 00	3
	86	D. Lautman	10 00	5
	89	Ben. Bateson	6 00	3
	90	H. Bellman	10 00	5
	91	W. Silver	6 00	3
	92	J. Fisher	5 00	2
15.	93	Noble & Foster	20 00	10
	94	Geo. Eldred	10 00	5
	95	Walter Bowers	6 00	3
	96	J. Crankshaw	6 00	3
	97	A. Lemon	10 00	5
	98	P. A. Burns	6 00	3
	99	C. C. Bedell	12 00	6
	100	D. R. Campbell	20 00	10
	101	W. R. Arnold	2 50	1
	102	O. W. Banks	3 00	1
16.	103	Hammon & Hickman	8 00	4
	104	A. J. Skinner	7 50	3
	105	Mr. Bartlett	15 00	7
	106	Jewelry	10 00	2
	107	Battle of Gettysburg	125 00	--
	108	Collected last day	6 20	--
		Total amount	$2,987 00	1,381

MONEY PAID TREASURER BY BUSINESS COMMITTEE.

Amount received from Booth leases	$2,987 00
Amount received from Check room	66 60
Amount received from Fountain sold	10 00
	$3,063 60

INVENTORY OF PROPERTY BELONGING TO THE MICHIGAN STATE AGRICULTURAL SOCIETY IN THE CITY OF JACKSON.

Articles Stored in Bee House.

400 Feet Field Shafting and Couplings.
42 Bridge Trees.
60 Feet Shafting and Bearings.
2 Iron Band Wheels.
1 Split Band Wheel.
1 Wooden Band Wheel.
1 Lot ¾ inch Water Pipe.
1 Lot ½ inch Water Pipe.
1 Lot 1 inch Water Pipe.
1 Smoke Stack, Flue Cap and Rods.
13 Lamp Posts.
1 Pair Shaft Hangers and Shaft,
2 Old Ladders.
1 Old Step Ladder.
1 Plow.
9 Long Water Tanks.
2 Square Water Tanks.
1 Grindstone.
10 Small Wooden Horses.
7 Posts for Fountain Fence.
1 Lot Stall Numbers.
1 Lot 4x4 Oak Stakes.
1 Lot 2x4 Pine Scantling.
1 Lot 2x4 old Lumber.
1 Lot Railing, Main Hall.
2 Rolls Wire for Shafting Cover.
1 Wheel Barrow.
3 Pump Heads.

Stored in Horticultural Hall.

1 Wagon and Water Tank.
1 Roller.
1 Road Scraper.
1 Drag.

Stored in Machinery Hall.

1 Line Main Shaft, Couplings, Boxes, etc.
1 Iron Band Wheel.
1 Wooden Band Wheel.

Stored in Business Committee Room.

1 Box Glass Jars (unopened).
1 Refrigerator.
11 Ticket Boxes.
14 Mattresses and 6 Pillows.
2 Old Bedsteads.
3 Iron Garden Rakes.
1 Straw Fork.
1 Scythe and Snath.
1 Bush Hook.
2 Wooden Rakes.
4 Sash and Glass.
1 Spade.
1 Scoop Shovel.
1 Post Augur.
2 Pitchforks.
1 Grub Hoe.
1 Pickaxe.
2 Wooden Signs.
1 Water Pipe Key.
1 Pair Iron Legs.
1 Hose Cart and Hose.
1 Piece Hose and Nozzle.
2 Watering Pots.
1 Roll Telegraph Wire.
1 Roll Barbed Wire.
1 Plantation Bell.
2 Oil Cans for machinery.
2 Whitewash Brushes and Pail.
3 Bundles Department Flags.
1 Mop.
2 Pieces Small Chain.
1 Hand Saw.
1 Sledge Hammer.
1 Carpenter's Square.
1 Tape Line.
1 Axe.
1 Branding Iron.
1 Pair Tackle Blocks.
1 Roll Rope.
3 Oil Cans.
1 Old Jug.
1 ½ Keg 8d Nails.
1 Dog Chain.
1 Snow Shovel.
1 Old Bushel Basket.
1 Pair Step Ladders—new.
1 Water Barrel.
1 Rubber Belt.
32 Chairs.
12 Brooms.
3 Pigeon Hole Boxes.
1 Blackboard.
10 Tables.
1 Extension Table and Leaves.
2 Big Oil Cans.
1 Set Stencil and Brush.
1 Piece Pump Log.
1 Roll Chicken Coop Wire.
1 Socket Wrench for Shafting.
1 Old Tub.
1 Box Keys.
1 Flag—"Ladies."
2 Pails.

Articles Stored in Boxes.

1 Box Gate Tickets—1885.
1 Box—43 Faucets and 24 Drinking Cups and Chains.
1 Box—22 Comfortables.
10 Boxes Street Lamps.
1 Box—11 Lamps and Chimneys.
1 Box—14 Lanterns.
1 Box—.... Pieces Pipe, 35 Cut-off Valves, 12 Globe Valves.
1 Box Pipe Fittings.
1 Box Baggage Checks.
4 Boxes Mosquito Bar for decorating.
15 Boxes Horticultural Society.
1 Box Door Rollers.
1 Box Old Wire.
1 Box Chicken Cups.
1 Box Banners including:
  1 Machinery.
  1 Big Rooster.
  1 Poultry Department.
  1 Agricultural.

Articles Stored in Boxes.—Continued.

1 Fine Art Hall.
2 Bee and Honey Hall.
1 Poultry Hall.
1 Fruit Hall.
1 Exposition Hall.
1 Police Station.
1 Apiary.
1 Baggage Checked.
1 Dairy Hall.
1 Secretary's Office.
1 Farm and Garden Produce.
1 Miscellaneous Hall.
1 Treasurer.
1 President's Room.
1 Lot "Sections."
1 Lunch.
1 Manufacturers.
1 Entrance.
1 Press Room.
2 Crop Correspondents' Headquarters.
2 Ticket Office.
1 Children's Department.
2 Streamers.
1 "Pomological Hall" Flag.
1 "State Fair" Flag.
1 "President" Flag.
1 Large U. S. Flag.
3 Small U. S. Flags.

Articles in Boxes sent from Kalamazoo, unopened, copied from last year's Inventory.

1 Clothes Boiler.
4 Tin Pails.
2 Dish Pans.
10 Window Curtains.
21 Wiping Towels.
20 Linen Towels.
8 Linen Table Cloths.
1 Brown Coffee Sack.
1 Pair Shears.
3 Doz. Silver Knives.
3 Doz. Silver Forks.
4 Mustard Spoons.
23 Tin Tablespoons.
1 Doz. Tin Teaspoons.
1 Large Iron Spoon.
5½ Doz. Iron Knives.
5½ Doz. Iron Forks.
3 Carving Knives.
1 Steel Sharpener.
54 Silver Teaspoons.
6 Butter Knives.
3 Silver Pickle Forks.
2 Silver Sugar Tongs.
10 Silver Tablespoons.
1 Silver Teapot.
3 Dripping Pans.
2 Frying Pans.
1 Cake Pan.
¾ Doz. Wash Dishes.
1 Doz. Tin Plates.
4 Tin Dippers.
2 Six Quart Pans.
1 Crumb Brush.
1 Scrub Brush.
3 Table Servers.
1 Coffee Boiler.
1 Tea Boiler.
1 Tea Kettle.
8 Coffee Pots.
3 Tin Cups.

Respectfully submitted.

A. O. HYDE.
J. C. SHARP.
H. O. HANFORD.

Report accepted and referred to Finance Committee.

REPORTS OF EXECUTIVE SUPERINTENDENTS.

The report on Cattle was presented by Supt. I. H. Butterfield.

DIVISION A—CATTLE.

To the President and Executive Committee of the Michigan State Agricultural Society:

The exhibit in the Cattle Department at the Fair of 1886 was, I believe, the largest ever made at any Fair of this Society. The exclusion of cattle from other States did not restrict the numbers.

The following from the books of the Secretary shows the number of entries and the amount of awards in each class:

Class.		Entries.	Awards.
1.	Shorthorns	207	$535
2.	Devons	45	398
3.	Herefords	98	485
4.	Jerseys	134	540
5.	Black Polled	60	375
6.	Holsteins	158	535
7.	Grade	42	$165
8.	Fat	29	220
	Non-enumerated	13	30
	Total	786	$3,283

So far as I am informed, this was the largest exhibit of cattle at any State Fair in 1886.

The awards made in most classes by experts were generally satisfactory, and but for the lack of accommodations exhibitors were satisfied. I earnestly hope that in the future accommodations may be ready at the beginning of the Fair for all stock entered for exhibition.

The practice of selecting single expert judges has worked to my entire satisfaction, and although increasing the expense somewhat, is in my opinion the best method for doing justice to both exhibitors and the Society.

In view of the large expense to the Society for forage, I think it would be best to limit to some extent the number to be shown by one exhibitor in any one class, allowing only sufficient number to make a fair show in the different ages.

I recommend that the premium for herds of thoroughbred cattle read "the herd to consist of one bull one year old or over, one cow four years old or over, one heifer three years old, one heifer two years old, one heifer one year old, one heifer calf," and that young herds be stricken out, and premium for bull and four of his get be added in classes 2, 3 and 5; also that a class be made for grade females for dairy purposes, making two grade classes, one grade of beef breeds and one of dairy breeds.

I. H. BUTTERFIELD,
Superintendent.

Report accepted and referred to Committee on Rules and Premiums.

The report on Horses was presented by Supt. Phillips.

DIVISION B—HORSES.

To the President and Executive Committee of the Michigan State Agricultural Society:

There were entered on the Secretary's books 551 horses, as follows:

Class.	Entries.	Awards.	Class.	Entries.	Awards.
9.	14	$ 76	17.	33	$173
10.	16	170	18.	45	171
11.	153	485	19.	31	480
12.	39	205	20.	30	470
13.	74	154	21.	10	225
14.	24	145	22.	15	180
15.	19	169			
16.	48	216	Total	551	$3,313

In this large number of horses there was not a poor one to be found, and I am fully satisfied that there is a marked improvement in the horses shown over former years, especially in the young animals.

In Class 15—Clydesdale and English Draft Horses Registered—this heading admits a cross of blood. I recommend that hereafter there be added a rule so definite that no cross breed can compete.

Class 16—Norman Percheron and other French Draft Horses Registered. The present rule reads, "all horses four years old or over entered in this class must weigh not less than 1,600 pounds, and the entry shall be accompanied with a reliable certificate of weight of not exceeding one week previous to the opening of the exhibition." It will be readily seen that this rule is an error, as many of the best Percherons do not weigh 1,600 pounds. For instance, Mr. Woodman's Duke of Perch, the horse Senator Chandler introduced, and Senator Palmer's imported stallion are all under 1,600. This last horse would have been given the first premium at the last Fair but for having been a little under weight. I recommend that this rule be stricken out.

GEORGE W. PHILLIPS,
Superintendent.

Report accepted and referred to Committee on Rules and Premiums.

The report on Swine was presented by Superintendent Lessiter.

DIVISION D—SWINE.

To the President and Executive Committee of the Michigan State Agricultural Society:

The total number of entries in this Division was 317, last year 315—the Poland Chinas taking the lead in number. The entries in each class were as follows: Berkshire, 17 entries, awarded $68.00; Essex, 59 entries, awarded $134.00; Suffolk and Small Yorks, 45 entries, awarded $131.00; Poland Chinas, 98 entries, awarded $134.00; Chester Whites and Large Yorks, 80 entries, awarded $122.00; Fat Hogs, 18 entries, awarded $31.00—making a total of $620.00 awarded in this department.

There was a good deal of dissatisfaction by the exhibitors of Jersey Red swine, because they were classed with the Large Yorks.

JOHN LESSITER,
Superintendent.

Accepted and placed on file.

The report on Poultry was presented by Supt. J. Q. A. Burrington.

DIVISION E—POULTRY.

To the President and Executive Committee of the Michigan State Agricultural Society:

The number of entries in Division E at the State Fair of 1886, was 764, against 249 at the Fair of 1885. A gain of 517.

The amount awarded in the regular classes was $291.00; discretionary, $21.00. Total, $312.00.

The very large number of entries rendered it impossible, with the limited space at our command, to so arrange the exhibit as to make it as attractive as it might have been under more favorable circumstances.

I would recommend a thorough revision of the Premium List in this division. Some additions should be made, and many things might with propriety be left out. I would also recommend that no discretionary premiums be awarded in this department.

J. Q. A. BURRINGTON,
Superintendent.

Report accepted and referred to Committee on Rules and Premiums.

The report on Farm and Garden Products was presented by Superintendent A. F. Wood.

DIVISION F—FARM AND GARDEN PRODUCTS.

To the President and Executive Committee of the Michigan State Agricultural Society:

As Superintendent of classes 35, 36, 37 and 38 in Division F, Farm and Garden Products, I would report:

That the display was one of the best ever made and much interest manifested. The Premium List was changed last year, adding to its attractions without increasing the amount of premiums. There were 524 entries, nearly double the number the year before, yet not as much money paid.

I would recommend naming the Standard varieties of wheat instead of White and Red Wheat; also of oats, and perhaps change some of the varieties of potatoes, as some are going out of date and new ones taking their places.

A. F. WOOD.
Superintendent.

Report accepted and referred to Committee on Premiums.

The report on Bees and Honey was read by the Secretary, as follows:

DIVISION H—BEES AND HONEY.

To the President and Executive Committee of the Michigan State Agricultural Society:

In Division H, Class 42, there was a good show of bees, honey and machinery necessary for properly conducting the various operations of a well regulated apiary. There were 120 entries in the division and $296 awarded in premiums. The exhibition was tastefully arranged and attracted the admiration of a large crowd of visitors each day of the Fair, There is manifestly a growing interest in the business of bee-keeping. The subject is an important one and worthy of the best thought and encouragement of this Society. In order to arrive at a correct conclusion of this important industry, I quote an extract of the report of the statistician of the northwestern Society of Bee-keepers for 1884: "Not more than 8 or 10 per cent of those favorably situated for the cultivation of bees are engaged in the pursuit. If even one-half of those favorably situated were so engaged, the annual product would not fall below $75,000,000 or $80,000,000 in value." It seems to me from the above quotation that the important interest of bee-keeping is yet to be developed. If the State Agricultural Society could offer some inducements to encourage beginners to make exhibits at the Fair it would be a step in the right direction. There is some diffidence on the part of beginners in competing with the old established bee-keepers, who go prepared to take all the prizes.

I would recommend that the Society offer a few premiums for the best exhibits of parties who have been in the business for not more than two years. I would further recommend that the building to be used for exhibition be covered with shingles or some other water-proof material. There was considerable damage done to property on exhibition last year on account of the roof leaking badly. I should feel remiss in my duty if I did not make favorable mention of the very interesting and instructive display of honey-producing plants and flowers exhibited by the State Agricultural College; also samples of honey made from different plants. I also feel under obligations to Messrs. Cutting and Hutchinson for their valuable aid, suggestions and assistance in the arrangement and management of the department. I expended in the department for the services of judge, $3.00.

M. J. GARD,
Superintendent.

The report on Vehicles was presented by Supt. F. L. Reed.

DIVISION J—VEHICLES.

To the President and Executive Committee of the Michigan State Agricultural Society:

At the last annual Fair held in Jackson there were 238 entries in Division J, Vehicles.

According to the rules for this division, no premiums were awarded, and no viewing Committee was appointed. Your Superintendent would mention as worthy of especial notice the display of light work by the Michigan Buggy Company of Kalamazoo, the Michigan Manufacturing Company of Jackson, the Kalamazoo Wagon Co., the Jackson Carriage Company; also the Courtland Wagon Company. Each exhibited very superior light work, marvels of neatness and beauty.

In short, the exhibit in this department was most complete in all classes of goods, from the cheap road cart to the finest carriage, and gave great pleasure to the multitude of visitors, who continually thronged the space allotted to the exhibit. I would recommend that the rule in this class allowing covered space for 25 jobs from one exhibitor be changed to read 15 jobs by one person or firm.

F. L. REED.

Report accepted and referred to Committee on Rules.

The report on Machinery was read by the Secretary, as follows:

DIVISION K—MACHINERY.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—There was a very good exhibit in the machinery department at the last Fair, it having been larger than for a number of years (the number of entries being 426). One of the most interesting exhibits was that of "mechanical work" by the students of the Agricultural College, which attracted a great deal of attention. The power supplied was entirely adequate for the wants of the department and the exhibitors expressed themselves as well pleased with their accommodations.

JOHN GILBERT,
Superintendent.

Report received and placed on file.

The report on Musical Instruments and Sewing Machines was presented by Superintendent M. P. Anderson.

DIVISION M—MUSICAL INSTRUMENTS, ETC.

To the President and Executive Committee of the State Agricultural Society:

GENTLEMEN—The number of entries in Division M was as follows:

Class 58	Number of entries,	21	Premiums offered,	$23 00
" 59	" "	3	" "	none
" 60	" "	0		
Total		24		

The interest in exhibits under Class 56, Musical Instruments and Sewing Machines, is growing rapidly. The display made by all the Sewing Machine companies was attractive.

I deem it proper to make special mention of the display made by the White, Domestic and Singer. As they do not exhibit for premiums, I believe their presence should be cultivated, for they make that portion of the hall occupied by them very pleasing to the public.

M. P. ANDERSON,
Superintendent.

Report received and placed on file.

The report on Forage was then read by the Secretary, as follows:

FORAGE.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—The Superintendent of Forage would respectfully report that the feeling in his department was universally good, but the circumstances were not as favorable as could be desired owing to the incompleteness of the grounds at the opening of the Fair, and the stalls and pens being so packed together that it was impossible to deliver the hay and straw without trouble and waste, carrying it long distances, and with the bad weather and the large stock on exhibition, which had to be tied to the fence and to any place that could be found, and which had to be fed on the ground, the large expenses were unavoidable. I would recommend that we charge 50 cents for every horse over six months old, and 50 cents for every head of cattle over six months; 25 cents for every sheep over that age, to be paid at the time of entry, for hay and straw for the week of the Fair.

E. W. RISING,
Superintendent.

The report was accepted and referred to the Committee on Rules.

Chief Marshal A. O. Hyde reported as follows:

MARSHAL'S REPORT.

Mr. President and Executive Committee Michigan State Agricultural Society:

It should be the aim of the Marshal and assistants to render all the aid in their power by promptness in helping arrange and carry forward the business intrusted to them. The direct and constant business of the Marshal and assistants is more thoroughly identified with the exhibition of cattle and horses during the Fair, than with other divisions. Any casual observer can see at a glance that their duties are constant, and it is only by their strict attention to work in aiding the superintendents in these heavy divisions, that enables them to get through with their overburdened classes. For instance, at the last Fair with a programme that required every moment of time allotted without interruptions, we had the great rain storm of Thursday, causing an entire suspension of examinations for several hours. Here was much time lost that must be made up in some way. In view of the great amount of work to be done, much thought and care must be used in so dividing the work by a well arranged programme that it may be made possible to get along without slighting, or going too hastily through the examinations of some of the very numerous classes. We beg leave to again remind the superintendents that in addition to good judgment a proper degree of prompt, business like dispatch is a very desirable qualification in the judges they may select. The Marshals return their sincere thanks to the multitude that attend the Fair, for their uniform good behavior and prompt compliance with all requests. Also to any fault finders for the great pains they take in preventing their complaints from reaching our ears.

A. O. HYDE,
Chief Marshal.

Report accepted.

Mr. Parsons presented an invitation, with the compliments of Mr. C. J. Whitney, asking the Executive Committee to visit his theatre to-morrow evening. Accepted with thanks.

Mr. Hanford moved that the address of the President be referred to a committee of three, to recommend a subdivision of subjects.

The motion prevailed, and the chair appointed as such committee Messrs. Hanford, Shoemaker and Reed.

The Committee then adjourned until nine o'clock Tuesday morning.

SECOND DAY.

Michigan Exchange, Detroit,
January 11, 1887.

The Committee resumed its session this morning. President Chamberlain in the chair.

The roll was called and the following members answered to their names: President Chamberlain, Messrs. Hanford, Ball, Lessiter, Cobb, Sharp, Hyde, Reed, Burrington, Wood, Shoemaker, J. P., Angel, Howard, Young, Butterfield, Anderson, Wells, Baxter, Phillips, and the Secretary.

The report on Farm Implements was presented by Superintendent C. W. Young, as follows:

DIVISION I—FARM IMPLEMENTS.

To the Members of the Executive Committee of the Michigan State Agricultural Society:

Gentlemen—In Division I, Farm Implements, there were 393 entries, as reported by the Secretary, but owing to the lateness of many manufacturers getting on the grounds with their goods, the number must have been very much increased—fully doubled or more.

The exhibition was the largest in the history of the Society, and very creditable to the manufacturers and to our Society also.

We have no recommendations to offer, but sincerely hope the present migratory system may be discontinued and a permanent location provided.

It is the universal expression of the exhibitors in this department that if a permanent location were made they would gladly erect, at their own expense, permanent buildings for their several exhibits, thereby doing away with the many inconveniences of the temporary assignment of space.

C. W. YOUNG,
ABEL ANGEL,
H. O. HANFORD.
Superintendents.

Report accepted and referred.

The report on Manufactures was read by the Secretary as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

The undersigned, Superintendent of Exposition Hall, containing the several departments of Fine Arts, Music, Needle Work, Children's Department, and General Manufactures, respectfully makes the following report, viz.: The hall was in fair order, with the exception of the roof, which was leaky and made considerable trouble and some damage to goods, but through the affability of the exhibitors generally and extra care of the watchman and general disposition to make the best of the situation there is no claim for damages, but it will be indispensable to have a new roof on the hall before another State Fair is held. The exhibitions in this hall in the various departments were very large and generally very full. Some of the departments were somewhat crowded but all were well and tastefully arranged. The exhibitors have generally been well satisfied with their spaces and positions, attention and awards.

As Superintendent of Division L—Manufactured Goods—I make the following report: The exhibition in most of the department was very full and good, of non-enumerated articles very large and attractive. Whole number of entries in Division L was 127, whole number of premiums offered $562. Whole amount awarded, regular, $245; discretionary, awarded and approved, $28: total awards in the department, $273. Division "L" comprises classes 52 to 57 inclusive. In Class 52, Materials, there were 17 entries, 13 of wool and 4 of flax. Premiums offered on wool were $45, awarded $42. Some of the samples of wool shown were of a very superior quality of their different grades; discretionary premium awarded on a very fine collection of wool, $7. Of flax 4 samples were exhibited, 3 of very fine quality; premiums offered $30, awarded $8.

Class 53—Factory-made Goods—Although on the recommendation of the Superintendents in this department in 1885, the premium offered in 1886 was $135, while none were offered in 1885, it still brought no exhibits worthy of mention in that class. Number of entries in Class 53 were 5, premiums offered $135, awarded $10.

Class No. 54—Articles of Dress—No premium offered in this class, 2 large entries, fine exhibit and attractive display.

Class 55—Articles of Leather and India Rubber—The exhibit in this class was large and mostly very good, the display of boots, shoes and leather especially was very fine; number of entries 33, premiums offered $100, awarded $48, discretionary premium on case of felt shoes and slippers $3.

Class No. 56—Articles of Furniture—Display and quality large and good. Number of entries 57, premiums offered $217, awarded $135: discretionary premiums awarded and approved in this department on 8 different exhibits of non-enumerated but meritorious articles, $18.

Class No. 57—Stoves, Iron Work and Ornamental Concrete Work—Number of entries 13, premiums offered $35, awarded $2; discretionary premium awarded in this department $2. While the number of entries in this class was small yet the display of all kinds of stoves, ranges, furnaces, floor tile, mantels, solid bronze, and door trimmings, and many other articles of that class of goods, was very large and good. The manufacture of stoves and ranges of all kinds and varieties is a great and important business, especially in the city of Detroit and in some of the interior towns, the goods finding an extensive sale not only in all parts of our own country, but in foreign lands, thereby attesting their superiority. The course adopted some years ago by this Society to offer no premiums on stoves, has resulted in *no* loss of interest in the annual exhibitions of this Society.

There is a very large class of articles embraced in this division of manufactured goods which are annually exhibited at our Fairs, on which there is no premium offered; but a large share of the articles are valuable products to the manufacturers, and of great utility to the consumer; and I recommend that a liberal policy be pursued by this Society for their exhibition by providing ample and proper room and other reasonable facilities to such exhibitors in this department.

HENRY FRALICK,
Superintendent.

Accepted and placed on file.

The report on Art was presented by Supt. W. J. Baxter, as follows:

DIVISION N—ART.

To the Executive Committee of the State Agricultural Society:

GENTLEMEN—As Superintendent of Division N, at the late State Fair, I would make the following report.

The entries in this department were more numerous, and the exhibits as a whole superior to those at any previous State Fair, giving evidence of a growing interest in art exhibits.

The number of professional artists who made entries was much larger than usual, and the exhibits exceptionally meritorious. The amateur list was very large, and gave gratifying evidence of taste, skill and culture.

Notwithstanding the clear instructions in the Premium List for the benefit of exhibitors, many meritorious exhibits failed to receive proper notice, from the fact that they were improperly entered, and being among "enumerated articles" could not be awarded discretionary premiums. Several artists who should properly have entered as amateurs, made their entries in the professional class, and so came in competition with professional artists of long experience and culture.

Something may perhaps be done in our next Premium List to give exhibitors a still clearer idea of the class in which their entries should be made.

Your Superintendent began early to correspond with persons regarded by him as having skill and experience in such matters, to secure entirely competent and disinterested judges, a matter of great importance and no little difficulty. He was fortunate in securing a committee of gentlemen whose acknowledged taste, ability and disinterestedness secured ready acquiescence in their awards, not only by the public but also by exhibitors, many of whom were necessarily disappointed.

The committee have made some suggestions as to offering premiums in future, which are commended to your attention. They recommend that premiums to young artists should be restricted to premiums for drawing by those under 16 years of age. Mere ambitious attempts by young artists they believe should not be encouraged.

The whole number of entries in Division N was as follows:

Division N, Class 61, enumerated 178, unenumerated 14, total	192
" " " 62, " 154, " 21, "	175
Total	367
Premiums offered in Class 61, $761.00: in Class 62, $174.00: total	$935 00
Awarded in Class 61, enumerated $638.00, unenumerated $17.00, total	$655 00
" " 62, " $123.00, " $13.00, "	136 00
Total	$791 00

I would express my obligation to the gentlemen who consented to act as judges, and who gave their entire time for two full days to a careful examination of the entire entries in the department, and whose awards were made strictly in accordance with the rules prescribed by the Society, with an earnest desire to so interpret them in any case of doubt or obscurity as to do full justice to exhibitors.

W. J. BAXTER,
Superintendent.

Report accepted and referred to Committee on Premiums and Rules.

The report on Miscellaneous was presented by Supt. Franklin Wells.

DIVISION P—MISCELLANEOUS.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—The undersigned Superintendent of Division P, Miscellaneous Department, would respectfully report as follows:

The number of entries in Class 68 was 58; in Class 69, 29, and in Class 70, 21; in all classes, 108. The premiums awarded in Class 68 were $72.00, in Class 69, $7.00, and in Class 70, $3.00, aggregating $82.00. The previous year, 1885, the entries numbered 44, and the premiums awarded were $40.00. It will be seen that the last year the amount of premiums awarded divided by the number of exhibits is a fraction over 76 cents, the previous year 88½ cents. I would suggest that in making up the Premium List for this department that the list be enlarged somewhat by enumerated articles, which I think can be done by looking over the lists of exhibits of the last and previous years.

The present superintendent being inexperienced in matters pertaining to Fairs, feels a great degree of delicacy in offering any suggestions, but I may be allowed, perhaps, to say that it is embarrassing and puts the superintendent in charge to great inconvenience, after looking over the lists of entries and arranging for them in his department, to find them scattered about in the different departments of the Fair, and sometimes results in disappointment to the exhibitor in not being visited by the proper viewing committee.

FRANKLIN WELLS,
Superintendent.

Report accepted and referred to Committee on Premiums and Rules.

The report on Dairy was presented by Supt. J. P. Shoemaker, as follows:

DIVISION G—DAIRY PRODUCTS.

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—As Superintendent of Division G, I beg leave to report:

The whole number of entries was 115. Class 39 had 62 entries; premiums offered, $100; premiums awarded, $85. Class 40 had 45 entries; premiums offered, $95; premiums awarded,$70. Class 41 had 8 entries; no premium; discretionary, $5. Total premiums offered, $200; awarded, $160.

The display was fairly good in all departments. The creamers attracted a great deal of attention. The yeast men were on hand and gave away enough to elevate this whole country. There was but one entry of cheese, which is not flattering to that part of the dairy interest. Butter and bread is shown to great disadvantage for want of proper protection, and I renew my former recommendation that arrangements be made for showing it under glass. The hall was not as attractive as it would have been had it all the entries belonging to it. One or more of the finest display entries was allowed to exhibit in another hall, leaving the space reserved for them blank till near the close of the Fair. I then found them on exhibition in Manufacturers' Hall; the place was then filled by outsiders. The best of feeling prevailed among exhibitors, and on the whole was very creditable.

J. P. SHOEMAKER,
Supt. Div. G.

The report on Sheep was presented by Superintendent D. W. Howard:

DIVISION C.—SHEEP.

To the President and Executive Committee of the Michigan State Agricultural Society:

The Superintendent of Division C would respectfully report: There was a large and creditable show of Sheep, the number of entries was five hundred and sixty-eight, an increase over the previous years, and were as follows:

Class 23, entries 117; Class 24, entries 105; Class 25, entries 44; Class 26, entries 39; Class 27, entries 60; Class 28, entries 74; Class 29, entries 23; Class 30, entries 52; Class 31, entries 20; Class 34, entries 34. Total amount of premiums awarded, $1,451.

I recommend a revision of the classes of Middle Wooled and Long Wooled Sheep, giving each recognized breed a separate class—beginning at Class 26, to read as follows:

Class 26, Southdown; Class 27, Shropshire; Class 28, Hampshire; Class 29, Oxford; Class 30, Leicester; Class 31, Cotswold; Class 32, Lincoln; Class 33, Fat Sheep.

That the premiums in each class be the same as now offered in Class 26.

That all Sheep in Classes 26, 27, 29 and 31, be registered in the respective registers of the breeds published in the United States.

And that the following rule be added: "In the several classes of sheep but one premium shall be awarded to an exhibitor for sheep of the same age, in the same class where there is no competition in the ring."

D. W. HOWARD,
Superintendent.

Accepted and referred to Committee on Premiums and Rules.

Supt. Phillips, to whom was referred a protest against the horse "Contest," presented a letter from Mr. Lockwood, the owner of "Contest."

Mr. Wood moved that the protest be sustained.

Mr. Ball moved to amend, by referring the protest back to Supt. Phillips. Lost.

After a lengthy discussion Mr. Wood's motion was carried by the following vote:

Yeas—Messrs. Ball, Cobb, Sharp, Wood, Young, Wells, Baxter and the President—8.

Nays—Messrs. Lessiter, Hyde, Burrington, Angel, Butterfield, Phillips and the Secretary—7.

Mr. Phillips moved that the Premium Committee be instructed to offer premiums for stallions in Class 17. Carried.

A motion to reconsider the vote on Mr. Phillips' motion was carried, and the matter referred to the Premium Committee.

Mr. Butterfield offered the following resolution:

WHEREAS, The prevalence of contagious pleuro-pneumonia among cattle in the city of Chicago, the largest cattle market in the country, greatly endangers the cattle interests of Michigan, as well as of the whole country, making it an absolute necessity that immediate measures be taken to completely eradicate this disease from the United States; therefore

Resolved, By the Executive Committee of the Michigan State Agricultural Society, that the Senators and Representatives in Congress from this State be earnestly requested to favor the early passage of what is known as the Miller Bill, the immediate purpose of which is to set in motion proper national machinery to stamp out contagious pleuro-pneumonia and other contagious diseases among cattle in the United States, and that the Secretary be instructed to forward a copy of this resolution to each Senator and Representative from this State.

Adopted.

A communication from Mr. D. Woodman was read as follows:

PAW PAW, *January 10th, 1887.*

Gentlemen of the Executive Committee of the Michigan State Agricultural Society:

For some years Whips Bros., from Marion, Ohio, have exhibited grains, grasses, vegetables, flour, feed, and other articles at our State Fairs. I believe they are the only exhibitors of such articles outside of this State. They seem to be professionals, and I am certain they only raise a part of their exhibits. One of them admitted that to me at the Fair of 1885. We presume their grain exhibits were prepared with great care, for only the committee saw them, as their bags were untied only for the committee, and tied again and removed as soon as the premium cards were placed. Not being able to find some of the premium cards, I was told they were tied up in Whips Bros.' bags, which was the fact. Now, their object in pursuing this course is evident, for all who have exhibited grains and seeds well know that they get mixed by being handled by visitors. But our Ohio visitors are bound to keep theirs pure. Their mill products were handled in the same way ; and let me ask what such exhibits amount to, except to those who draw the premiums. We did suppose the object of our fairs was to show visitors our products, as well as to secure premiums, but not so with our Ohio friends. I believe they carried away $125 or over in premiums at our last Fair, and $175 the year before. We believe that money should have been kept within the State, by giving it to home exhibitors. Those Ohio exhibits would scarcely have been missed had they not been there, and we suggest whether it would not be advisable to exclude such exhibitors from competing at our State Fair. We think your action unjust in cutting out the premiums offered on grains in straw, showing the length and condition as grown in the field. This was the most important and interesting exhibit in the grain department, and would have been sadly missed from my collection had it not been there. Yet no inducement was offered for bringing it. We think when one of you grow, prepare and exhibit a collection of the magnitude of mine at the last State Fair, you would be willing to increase rather than cut off the small premiums formerly offered. We think we are safe in saying there was not another exhibition in Agricultural Hall that cost half the labor or money that mine did. And yet you pay 60, 40 and 20 dollars to professional gardeners ; $25 on potatoes, $6 on a bushel of wheat, and $5 on ten pounds of maple sugar, and $10 on an exhibit of hundreds of varieties of grain in straw, costing months of labor, and claimed by many visitors to be the most interesting exhibition on the grounds.

Hoping that these suggestions will be received with the same kindness in which they are written, and that we all may do what we can to aid our State Agricultural Society.

I am respectfully yours,

D. WOODMAN.

Accepted and referred to Committee on Premiums.

Mr. Phillips referred to the death of Mr. F. V. Smith, and moved that a committee of three be appointed by the chair to take proper action upon the death of Mr. Smith, and that Mr. W. J. Baxter be named as chairman of such committee.

The motion was unanimously adopted.

The President announced as such committee, Messrs. W. J. Baxter, Geo. W. Phillips and A. F. Wood.

On motion of Mr. Sharp it was

Resolved, That the Premium List Committee be instructed to take into consideration the desirability of amending the rules of Division C, whereby American Merino Sheep that may be recorded in the American Merino Register, shall be eligible to compete in the several classes of thoroughbred Merino Sheep.

The Secretary read the following communications:

From James S. McBride and fifteen others, asking that a special class be made for Duroc Jersey Red Swine.

Accepted and referred to Committee on Premiums.

From W. M. Hilbert, asking that a special class be made for small Yorkshire swine.

Accepted and referred to Committee on Premiums.

From Charles F. Mills, Secretary American Clydesdale Association, offering two gold medals to be awarded at the Michigan State Fair of 1887.

Accepted and referred to the Committee on Premiums.

The Committee on President's Address reported as follows:

That so much of the address as refers to permanent location, the amending of Article Five, and procuring State aid be referred to a committee of three; that so much as refers to the Military drill be referred to the Business Committee; that so much as refers to the Horticultural Society be referred to a special committee of three; so much as refers to the salaries of officers be referred to a special committee of three, so much as refers to attendance tickets given to renters of boots, and so much as refers to one superintendent to take charge of all the departments except Stock and Agricultural Implements, up to the time of opening the Fair, be referred to the Committee on Rules; so much as refers to the expense of printing be referred to the Committee of the Whole; so much as refers the exhibits in the Art Department be referred to the Premium List Committee; so much as refers to holding the Fair the present year in the city of Jackson be referred to the Committee of the Whole.

All of which is respectfully submitted.

H. O. HANFORD,
J. P. SHOEMAKER,
F. L. REED.

Accepted and adopted.

The Committee on Premiums was then appointed as follows:

Messrs. Wm. Ball, Geo. W. Phillips, James M. Turner, W. J. Baxter, I. H. Butterfield, J. P. Shoemaker and C. W. Young.

Mr. Sharp read the following communication:

JACKSON, MICH., *Jan. 7, 1887.*

At the annual meeting of the "Jackson County Agricultural Society," held this day, the following resolution was offered and adopted:

Resolved, That the Board of Directors are hereby authorized to determine relative to the holding of a "County Fair" the ensuing year, and that John C. Sharp, one of said directors, be instructed to confer with the Executive Board of the "State Agricultural Society," and ascertain at the earliest possible date, if they will require the grounds of the "Jackson County Agricultural Society" for the holding of a State Fair there in this present year; if so, the said grounds are hereby cheerfully granted to said State Agricultural Society for said use.

J. W. BARRY,
Secretary of Jackson Co. Agricultural Society.

Accepted.

Mr. Sharp offered a resolution, which was on motion laid on the table until after dinner.

The Committee then took a recess until 2 o'clock.

AFTERNOON SESSION.

The Executive Committee resumed its session at 2 o'clock P. M.

Upon motion, Mr. Sharp's resolution was taken from the table and read as follows:

Resolved, That the annual Fair of this Society for the year 1887 be and the same is hereby located at Jackson, on the Jackson County Fair Grounds, provided responsible parties at Jackson shall enter into contract with the Business Commitee, guaranteeing to the Society all the rights, privileges and immunities agreed to be given to the Society for the Fair of 1886, under the contract made by and between a committee of citizens of Jackson of the one part and this Society of the other part; and in addition providing for the continued ownership by the Society of its property of every kind put on said Jackson grounds outside of the provisions of said contract in 1886 and in 1887, with the right to remove the same, and also that the roofs of the buildings and sheds on said Fair grounds shall be put in good repair and condition, suitable for the purposes for which the several buildings are to be used, on or before August 1, 1887, to the satisfaction and acceptance of the Business Committee, and in default thereof, that the Business Committee put the same in such condition and repair, the cost of the same to be paid by said citizens' committee of Jackson.

Adopted by the following vote:

Yeas—Messrs. Hanford, Ball, Lessiter, Cobb, Sharp, Hyde, Reed, Burrington, Wood, Turner, Shoemaker, J. P., Angel, Howard, Young, Butterfield, Anderson, Wells, Baxter, Phillips, President Chamberlain, Treasurer Dean and Secretary Sterling—22.

Nays—None.

On motion the Secretary was instructed to send a copy of the resolution to M. H. Ray, Esq., President of the Jackson County Fair.

Mr. Baxter offered the following, which was adopted by the following vote:

Yeas—Messrs. Hanford, Ball, Lessiter, Cobb, Sharp, Hyde, Reed, Burrington, Wood, Turner, Shoemaker, J. P., Angel, Howard, Young, Butterfield, Anderson, Baxter, Phillips, President Chamberlain, Treasurer Dean and Secretary Sterling—21.

Nays—None.

WHEREAS, This Committee has learned with sincere regret that Prof. T. C. Abbot for twenty-seven years connected with our Agricultural College, for twenty-two of them as President, and now a Professor, is in miserable health, rendering the active performance of his duties at the College exceedingly painful and difficult.

Resolved, That in consideration of his long, efficient and valuable services to the College and the State, and of the present condition of his health, this Committee deem it proper and appropriate to suggest to the State Board of Agriculture that it would be no more than a just and suitable recognition of Prof. Abbot's long and valuable services, to give Prof. Abbot indefinite leave of absence from the active duties of his professorship, to enable him, if possible, to recuperate his health and strength; and that during such suspension of active service, his salary be continued, and this Committee agree with the State Board of Agriculture that such action on their part would meet with the hearty approval of this Committee, and as they believe, of the entire people of the State.

On motion the Secretary was instructed to forward a copy of the resolution to each member of the State Board of Agriculture.

The following report was then read and adopted by a unanimous vote:

To the Executive Committee of the State Agricultural Society :

GENTLEMEN:—Your Special Committee appointed to prepare resolutions relative to the death of our late associate, F. V. Smith, would recommend the adoption of the following preamble and resolutions :

WHEREAS, Since our last meeting, one who for many years was an earnest, active and efficient member of this Committee, one of our most valued friends and associates in the State Agricultural Society, has been removed by death: therefore

Resolved, That in the death of our friend and associate, F. V. Smith, our Society has lost one of its earliest and warmest friends and supporters, this Committee an active, efficient and useful counselor and co-laborer, and all of us as individuals, a much loved friend and companion, whose genial face and kindly greeting we shall greatly miss, whose vacant place for many of us who have been his life-long associates, can never be filled.

Resolved, That we extend to the bereaved widow and family our sincere condolence and sympathy, and assure them that as the beloved family of one whom we all greatly loved, they will ever have a warm place in our hearts.

Respectfully submitted,
W. J. BAXTER,
G. W. PHILLIPS,
A. F. WOOD,
Committee.

The Secretary read the following communication:

YPSILANTI, *January 10, 1887.*

Hon. William Chamberlain, President State Agricultural Society :

DEAR SIR—I herewith resign the office of member of the Executive Committee of the State Agricultural Society, and take this opportunity of thanking you and the members of the Society for the many kindnesses shown me by them. Wishing for the future success of the Society, I remain

Respectfully yours,
JOHN GILBERT.

Upon motion the Secretary was instructed to write Mr. Gilbert and ask him to withdraw the resignation.

Chairman Cobb of the Transportation Committee presented the report of the Committee:

To the President and Executive Committee of the Michigan State Agricultural Society :

GENTLEMEN—Your Committee on Transportation would respectfully report as follows:

The Michigan Central and its branches carried all articles to and from Jackson free, and passengers at half fare: also Chicago & Grand Trunk R. R. Co., Detroit, Grand Haven & Milwaukee, and Flint & Pere Marquette the same. All the other roads carried at half fare both passengers and articles for exhibit.

There was but two dollars paid for switching, and that was for switching the Oregon Exhibition Car. The Michigan Central, Grand Trunk and Lake Shore roads unloading at their respective depots, consequently all switching charges were saved. As far as your committee were able to learn, general satisfaction was given. We feel that great credit is due to the management of the different roads leading into Jackson for the kind and prompt assistance rendered at the last Fair.

Inasmuch as all railroads in this State are operating under franchises granted by the people, many of them having had land grants sufficient to construct the roads, we think the people, wherever situated throughout the State, should have accorded them equal rights and privileges for getting their exhibits to the annual State Fair, and inasmuch as the future prosperity of all railroads in this Stace is dependent upon the future growth and development of our natural resources, which should be fostered by them as well as by this Society, this Committee would urge upon the Society the passage of resolutions at this meeting, calling upon all our Senators and Representatives elect for the passage, during the present session of the Legislature, of a law which will require all roads in the State to hereafter grant the same facilities to exhibits and passengers to the State Fair as were this year so cheerfully granted by the Michigan Central, Chicago & Grand Trunk and Flint and Pere Marquette systems; said law to provide for the transportation of exhibits to and from the annual State Fairs free of charge, and for passengers at half fare, the exhibits to be billed to the Fair at tariff rates and returned free, the amount first paid to be refunded to the shipper-exhibitor upon presentation of his certificate that there had been no change of ownership, with the certificate of the Secretary of this Society, that the articles or stock named had been on exhibition at the State Fair. This Committee regards the passage of such a law as the only method by which we can possibly secure fair and uniform treatment of would-be exhibitors at the State Fair, from whatever part of the State they may happen to come.

W. H. COBB,
JAMES M. TURNER.

Accepted and referred to Committee to be appointed on that part of President's address relative to legislation.

Treasurer Dean then submitted his annual report.

TREASURER'S REPORT.

Fair Held at Jackson, 1886.

January, 1886. Balance cash on hand	$9,888 81
Receipts During Current Year.	
Membership certificates	$1,030 00
Gate admission	17,080 00
Booth and ground rents	2,987 00
Sale of fountain	10 00
Check room	66 60
Stall rent by J. C. Sterling	477 75
William Ball	2 50
Interest account	210 00
Premium on sale of $6,000 bonds	1,696 50
	$33,449 16

Disbursements.

Paid business orders	$15,019 98
Paid premium checks	11,123 00
Paid Horticultural premium checks	800 00
Paid check of previous issue	20 00
Balance cash on hand	6,486 18
	$33,449 16

A. J. DEAN,
Treasurer.

Report accepted and referred to Finance Committee.

The report on Police was presented by Supt. J. C. Sharp.

JACKSON, MICH., *December 24, 1886.*

To the Executive Committee of the State Agricultural Society:

GENTLEMEN—The Superintendent of Police would respectfully report that the expenses for police during the Fair were as follows:

Night police and watchmen	$131 25
Day police	251 00
Total	$382 25

The expense was larger than usual owing to the necessity of employing a number of police on Sunday prior to the Fair, and because of increased wages paid. The usual wages paid was $1 75 per day instead of $1.50, and in a few instances $2.00 per day. The total number of men employed was 54, who served from one-half day to six days each.

General good order was preserved upon the grounds; no drunkenness or intoxication was reported; there was entire freedom from accident, and only a few thefts were reported, and they of a character to leave some doubt as to whether the loss was not the result of carelessness. The only arrest made was for breaking into the grounds.

JOHN C. SHARP,
Superintendent of Police.

Accepted.

The report of General Superintendent Cobb was submitted as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—Your General Superintendent would respectfully report that with one exception general good order prevailed during the entire Fair; every Superintendent seemed well qualified for the position assigned him, especially Superintendents Phillips of the Horse department and Butterfield of the Cattle department; they both showed a large amount of coolness while waiting for stalls for the stock they were called upon to look after, and while the Business Committee were compelled to work as it were with hands tied, they also by keeping cool accomplished a large amount of work in a very short time. The rain on Thursday was to be regretted, yet it was beyond the control of any committee. The closing of one booth was the only unpleasant duty that the Superintendent was called upon to witness, aside from the uncomfortable traveling after the rain.

All of which is respectfully submitted.

W. H. COBB,
General Superintendent.

Report accepted.

The President appointed as Committee on Rules, Messrs. H. O. Hanford, W. H. Cobb, John Lessiter.

The committee voted a recess until 9 o'clock Wednesday.

THIRD DAY.

MICHIGAN EXCHANGE, DETROIT,
January 12, 1887.

The Executive Committee resumed its session this morning, President Chamberlain in the chair.

The roll was called and the following members answered to their names:

President Chamberlain, Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Hyde, Reed, Burrington, Wood, Turner, Shoemaker, J. P., Angel, Howard, Young, Butterfield, Anderson, Wells, Baxter, Phillips, Treasurer and Secretary.

On motion the minutes of the preceding meeting were approved without reading, and the President appointed the following Special Committees:

On that part of the President's address relative to State Aid: Messrs. Turner, Webber and Cobb.

On that part relative to the Horticultural Society: Messrs. Wells, Wood and Angel.

On that part relative to Officers' Salaries: Messrs. Burrington, Reed and Anderson.

The report on Gates was presented by Superintendent Wm. Ball, as follows:

To the President and Executive Committee of the State Agricultural Society:

The Superintendent of Gates would respectfully report that at the gates good order prevailed. The gatekeepers did their duties with commendable zeal and good judgment. The plan adopted last year of having the color of ladies' attendant tickets red, and gentlemen's attendant tickets yellow, worked well, and would recommend a continuance of the plan. The color might be changed if thought desirable, but should be so stated in the report of the Committee on Rules. Would also recommend the continuance of the small gate, where all such tickets should be received. A good deal of annoyance is frequently caused renters of booths by being obliged to get their supplies on the grounds before a certain hour in the morning. Many do not know what they may require for the day so early, and are necessarily put to a good deal of trouble and some unjust expense in getting needed supplies. I would recommend that those renting booths, who need supplies at different times through the day, be allowed the privilege of having such supply wagon pass in upon the grounds during the day for the purpose of bringing supplies when needed.

Such wagons shall be designated in some way satisfactory to the renter of booths, or the Gate Superintendent, or both, and shall pass in and out through some particular gate, and be driven by one man, and he alone shall be allowed to pass through the gate on a supply wagon. It would avoid a good deal of unjust censure of the Superintendent and gatekeepers who try to carry out the prescribed rules, that all supplies must be on the grounds before 8 o'clock A. M. of each day.

Touching the matter of issuing tickets for booth renters and their employés, I have no recommendation to make, but some plan should be devised that shall be just to the Society and also to those why pay money for their privileges.

All of which is respectfully submitted.

WILLIAM BALL.

Accepted and referred to the Committee on Rules.

Mr. Franklin Wells, president of the State Board of Agriculture, invited the Committee to visit the Agricultural College in June.

Invitation was accepted.

The President announced as the Committee on Finance, Messrs. Anderson, Wells and Howard.

The Committee took a recess until 2 o'clock.

AFTERNOON SESSION.

The Executive Committee resumed its session pursuant to adjournment, the President in the chair.

The Committee on Conference with the committee from the Horticultural Society, reported verbally. After a lengthy discussion the report was referred back to the committee.

The committee on that part of the President's address referring to the salaries of officers, reported as follows:

To the President and Executive Committee of the State Agricultural Society:

Your committee to whom was referred that portion of the President's address relating to salaries, would respectfully report that they have had the same under careful consideration, and would recommend that the salary of the Secretary for the coming year be fixed at eight hundred dollars ($800); and that the Treasurer be allowed the sum of one hundred dollars ($100) for the services of a book-keeper.

Repectfully submitted,

J. Q. A. BURRINGTON,
F. L. REED,
M. P. ANDERSON,
Committee.

The report was adopted by the following vote:

Yeas—President Chamberlain, Messrs. Hanford, Ball, Reed, Burrington, Turner, Shoemaker, J. P., Howard, Young, Butterfield and Anderson—11.

Nays—Messrs. Rising, Lessiter, Hyde, Baxter, and Phillips—5.

Mr. Turner moved to reconsider the vote.

The motion prevailed and the report was tabled.

The Finance Committee reported as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—Your Committee on Finance to whom was referred the reports of the Secretary, Business Committee and Treasurer, would state that they have made a careful examination of all books and vouchers, and find their respective accounts as rendered to this Society correct; also, that the bond of the Secretary has been received, approved and deposited with the President.

M. P. ANDERSON,
FRANKLIN WELLS,
D. W. HOWARD,
Finance Committee.

Accepted and adopted.

The President then announced the following committees:

Business Committee—Hyde, Sharp, Wells.
Transportation Committee—Cobb, Turner, Ball.
Committee on Printing—Dean, Sterling, Sharp.
Committee on Reception—M. Shoemaker, Humphrey, Parsons.
Committee on Programme—Phillips, Butterfield, Hyde.
General Superintendent—H. O. Hanford.
Gates—Wm. Ball.
Police—W. H. Cobb.
Chief Marshal—A. O. Hyde.

The Committee on Conference with the Horticultural Society presented the following report:

To the President and Members of the Executive Committee of the State Agricultural Society:

GENTLEMEN—The Special Committee appointed to communicate with the Committee from State Horticultural Society, beg leave to recommend as follows: To offer to the Society to make a premium list of $800, and pay the Society in cash $600.

All of which is respectfully submitted.

FRANKLIN WELLS,
A. F. WOOD,
ABEL ANGEL.

Accepted and adopted.

The report on Horticulture was presented by Secretary Garfield.

GRAND RAPIDS, *Jan. 8, 1887.*

Mr. President and Gentlemen of the Executive Committee:

A complete report of the exhibit in Pomological Hall will appear in my forthcoming report, of which you will each have copies. But the closing paragraphs of that report I think you may be interested in sufficiently to have them reproduced here at your winter meeting.

With the experience of the exhibition freshly before me, I cannot refrain from making a few suggestive notes:

1. It is a great mistake for any exhibitor of fruits to attend the Fair without having his varieties so packed and labeled as to enable him to place his collections upon plates rapidly and without error. It is not safe or discreet at such times to trust one's ability to sort out varieties and name them, no matter how good a pomologist he may be.

Striking examples of the neglect to carry out this simple rule, and its consequent results, were numerous at the last Fair. Men who came from a long distance, getting to the exhibition late, because of their perfect methods of packing and labels had large collections in shape for committees at the appointed hour; while others with small exhibits, who brought their specimens direct from the orchard to the grounds in baskets, were unprepared for the committee, and their collections were dotted with mistakes in nomenclature.

2. The plan of limiting collections to a number which should cover the best varieties for the purpose indicated in the offering, is a valuable provision for the exhibitors, the Society and the visitors. It gives opportunity for exhibitors to use their judgment with regard to the value of varieties, knowing as they do that mere numbers count nothing beyond the limit set. It enables the Society to plan for an exhibit of which they know

something about the proportions when the entries are made. It gives visitors an opportunity to compare the judgments of men with reference to the best varieties of a stated number.

3. For the first time in the history of the Society all bars were removed from in front of the tables of fruit, and even with the same number of watchmen, there was less complaint from theft than usual. There is no question but that the bars are now down "for keeps." A little more police force will be required, and there should be large placards notifying people to keep "hands off," and then make examples of those who wilfully break the rule. It is as good a place at the Fair, to teach honesty and good manners, as it is to have fun; and our Society may as well become an educator in this direction.

4. Our experience in the securing of experts from abroad to award the premiums is most favorable to the plan. We may have men of just as good judgment, and just as honest as any we can import, but in every instance the awards made by the visiting judge will give the greater satisfaction. Why would it not be expedient for societies to arrange an exchange in this matter of committee work? The expense would be light, and the results would certainly be valuable.

5. Florists or amateur plant growers never should make an exhibit at a Fair without a clearly defined plan of what they intend to do. Everything depends upon arrangement for effect. And one cannot afford to do his experimenting to produce effects after the Fair opens.

6. The educational exhibit of varieties, which shall include everything that can be gathered, showing the weak points as well as the strong points in each sort, and giving as much information as is possible upon labels, with an expert near at hand to answer questions. becomes an indispensable accessory to our Fairs, when we limit the large competing collections to the *best* varieties. And this is the safest way to show the poorer sorts, as no one will be deceived by a handsome appearance or great size; for the grading of the variety will be upon its label. Again, it is invaluable, connected with an exhibit of this sort, to have cases of injurious insects and tree branches, galls and blights. It is entirely practicable for a society to give information in this way, and thus pave the way for better methods and purposes in the conducting of our Fairs.

7. The experiment of showing bedding plants in beds as they would appear upon the lawn proves a success. It is the only proper way to award premiums upon plants used for bedding purposes; and the exhibition of good taste in the employment of bedding plants is as important a thing to award a premium upon as the selection of appropriate plants with which to adorn the beds. The accomplishment of the best results in this direction, however, depends largely upon a further suggestion:

8. That the Fair should have a permanent location. Then bedding and decorative plants could be shown with the surroundings which intensify effects desirable to be produced, and while accomplishing this purpose for the sake of a premium or advertisement the exhibitor adorns the grounds about the building, and renders the whole display more attractive to exhibitors.

9. The further experience with canned fruits leads to the conclusion that it is impossible to get much satisfaction from an exhibit in this department. With the present proficiency on the part of housewives in the canning of fruits, it is utterly impossible for a committee to determine which is the best of several collections, without testing each jar, which is manifestly out of the question. The securing of a premium in this division thus becomes a matter of lottery. It is really questionable if the stimulating

of large exhibits in this department is conducive of results at all commensurate in value with the labor of making and caring for the exhibits.

10. The scheme of securing competitive wall and table exhibits of horticultural products, gathered and arranged solely with reference to their decorative value, is certainly a commendable one, and ought to bring out the good taste, especially of younger people who delight in work of this kind.

Respectfully submitted,

CHAS. W. GARFIELD.

Accepted.

On motion it was

Resolved, That this Committee ask the Legislature to appropriate one thousand dollars towards the expense of preparing the report of the proceedings of the Society for publication, and to appropriate the like amount toward the preparation of the report of the Horticultural Society for publication ; that the members of this Committee, so far as practicable, exert themselves to secure favorable action by the Legislature, and that the Legislative Committee be instructed to bring the matter specially to the attention of the Legislature, and to secure the appropriations.

On motion of Mr. Hyde, President Chamberlain was appointed an active member of the Committee on State Legislation.

On motion a recess was taken until 8 o'clock.

EVENING SESSION.

The Committee resumed business at 8 o'clock P. M.

The roll was called and the following named members found present:

The President, Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Hyde, Reed, Burrington, Wood, Turner, Shoemaker, J. P., Angel, Howard, Young, Butterfield, Anderson, Wells, Baxter, Phillips, the Treasurer and the Secretary.

A letter was read from ex-President James Bailey expressing his regret at not being able to attend this meeting.

The Premium Committee presented their report, fixing the Premiums to be offered at the Thirty-ninth Annual Fair, which was adopted.

The report of the Committee on Rules was presented by Chairman Hanford.

Adopted.

The following resolution was unanimously adopted:

Resolved, That the thanks of this Committee be and are hereby given to Manager C. J. Whitney for courtesies extended to us on Tuesday evening. Also to the Michigan Central and the Detroit. Grand Haven & Milwaukee Railroads for returning the members of this Committee to their homes. so far as traveling over their respective roads, free of charge.

It was then

Resolved, That the Locating Committee be composed of the President, Secretary, Treasurer, Business Committee and Transportation Committee.

Resolved, That in case a contract cannot be secured from responsible citizens of Jackson, in accordance with the terms and conditions of the resolution locating the Fair at Jackson, for 1887, within one month from this date. that then, and in that case the

Locating Committee be and they are authorized to locate the Fair at such place and on such terms as shall be satisfactory to them.

The President announced the following Executive Superintendents:

Cattle—Butterfield.
Horses—Phillips.
Sheep—Howard.
Swine—Lessiter.
Poultry—Burrington.
Miscellaneous—Wells.
Fine Art—Baxter.
Music—Anderson.
Children's Department—Anderson.
Needle Work—Anderson.
Manufactures—Fralick.
Agriculture—Wood.
Machinery—Gilbert.
Farm Implements—Young, Angel, Hanford.
Dairy—Shoemaker.
Vehicles—Reed.
Bees and Honey—Smith.
Forage—Rising.

Mr. Lessiter moved to reconsider the vote adopting the report of the Premium Committee.

The motion prevailed.

The same gentleman then moved to amend the report by striking out the word "Lincoln" in Class 30.

Carried.

The report of the Premium Committee as amended was then adopted.

On motion the report of the Committee on Salaries was then taken from the table.

Mr. Baxter moved to amend the report by substituting $1,000 for $800 as the salary of the Secretary.

Carried by the following vote:

Yeas—Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Hyde, Wood, Turner, Young, Butterfield, Anderson, Baxter, Phillips—14.

Nays—Messrs. Shoemaker, J. P., Angel, Howard, Wells, and President Chamberlain—5.

Mr. Burrington moved to further amend by substituting $400 for $100 as the amount to be paid Treasurer's book-keeper.

Carried.

The report as amended was lost by the following vote:

Yeas—Messrs. Rising, Hanford, Lessiter, Cobb, Burrington, Anderson, Baxter, Phillips—8.

Nays—Messrs. Ball, Hyde, Reed, Wood, Turner, Shoemaker, J. P., Howard, Young, Butterfield, Wells, and the President—11.

Mr. Turner moved, and it was supported, that the President and Secretary be instructed to make necessary arrangements to have the business office of the Society located in the Capitol building at Lansing.

Lost by the following vote:

Yeas—Messrs. Rising, Burrington, Wood, Turner, Shoemaker, J. P., Young, Butterfield, Wells, Baxter and the President—10.

Nays—Messrs. Hanford, Ball, Lessiter, Cobb, Reed, Angel, Howard, Anderson, Phillips and the Secretary—11.

Mr. Hanford was then called to the chair.

President Chamberlain then moved that the salary of the Secretary for the coming year be fixed at $800.

Mr. Baxter moved to amend by making it $1,000.

Mr. Baxter's amendment was carried by the following vote:

Yeas—Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Hyde, Reed, Young, Anderson, Baxter, Phillips—11.

Nays—Messrs. Burrington, Wood, Turner, Shoemaker, J. P., Angel, Howard, Butterfield, Wells and the President—9.

The motion as amended was carried by the following vote:

Yeas—Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Hyde, Reed, Young, Anderson, Baxter, Phillips—11.

Nays—Messrs. Burrington, Wood, Turner, Shoemaker, J. P., Angel, Howard, Butterfield, Wells, President Chamberlain—9.

Mr. Anderson moved that the Treasurer be allowed $400 for book-keeper's salary.

Mr. Hyde moved to amend by making it $100.

Amendment was lost.

Mr. Anderson's motion was then carried by the following vote:

Yeas—Messrs. Rising, Ball, Lessiter, Reed, Burrington, Wood, Shoemaker, J. P., Howard, Young, Butterfield, Anderson, Wells, Baxter, Phillips and the Secretary—15.

Nays—Messrs. Hanford, Cobb, Hyde, Turner, Angel, President Chamberlain—6.

Mr. Turner moved that the President be allowed $400 for a clerk.

Tabled.

On motion of Mr. Ball it was

Resolved, That if the Horticultural Society do not accept the proposition made them by this Committee within sixty days, that the Premium List of the Horticultural department of last year be adopted as the list for 1887.

It was then resolved that the Fair of 1887 be held on September 19, 20, 21, 22 and 23.

Recess was then taken till 8 o'clock Thursday morning.

FOURTH DAY.

MICHIGAN EXCHANGE, DETROIT,
January 13, 1887.

Executive Committee resumed its session this morning at 8 A. M.

The roll was called and the following members answered to their names: President Chamberlain, Treasurer Dean, Messrs. Rising, Ball, Lessiter, Cobb, Hyde, Reed, Wood, Turner, Shoemaker, J. P., Howard, Young, Butterfield, Anderson, Wells, Phillips, and the Secretary.

An informal discussion was held on the subject of "special attractions."

The committee appointed at the last winter meeting to prepare a testimonial for Mr. Cobb, reported as follows:

The Executive Committee of the State Agricultural Society fully appreciating the faithful labors of Wm. H. Cobb in behalf of this Society while acting as chairman of the Business Committee, and knowing the responsible position he has held without any remuneration, therefore

Resolved, That the thanks of this Committee are hereby tendered to Mr. Cobb.

WM. CHAMBERLAIN,
A. J. DEAN.

Adopted by a rising vote.

On motion the Business Committee was instructed to provide Register gates for the next annual Fair.

On motion the Committee adjourned *sine die.*

WM. CHAMBERLAIN,
President.

J. C. STERLING,
Secretary.

LANSING MEETING.

LANSING, *June 1, 1887.*

In pursuance of a resolution adopted by the Executive Committee at the last winter meeting, a meeting was held this evening at the Hudson House. President Chamberlain in the chair.

The roll was called and the following named gentlemen found present: President Chamberlain, Messrs. Ball, Rising, Hanford, Hyde, Lessiter, Reed, Smith, Burrington, Wood, Turner, Shoemaker, J. P., Shoemaker, M., Howard, Anderson, Wells, Baxter, Phillips, Fralick and the Secretary.

Chairman Hyde of the Business Committee reported that the fire on the Jackson County Fair Grounds destroyed about one hundred and fifty cattle stalls and two hundred sheep and swine pens, that the roofs on Main Hall, Horticultural and Agricultural Halls are in very bad condition and the grounds and balance of buildings in very good order.

The Secretary reported that Mr. Hatch had not furnished proof that his stallion Hambletonian Gift was standard at the time of the last Annual Fair. Upon motion Mr. Hatch was given further time to furnish evidence.

Col. Shoemaker moved and it was supported to reconsider the motion adopted at the last meeting of the committee sustaining the protest against the award to the stallion "Young Contest" in class 15. The motion prevailed and Mr. Wood moved that the protest be sustained. Mr. Wood's motion was lost and "Young Contest" awarded the premium.

On motion of Mr. Ball it was resolved that if the Business Committee offer a prize for a Military drill the amount offered shall not exceed $1,000.00, and that the drill be held under the auspices of the Society with no division of gate receipts.

After a lengthy discussion on the subject of transportation the committee adjourned to meet at 8:30 o'clock to-morrow A. M.

HUDSON HOUSE, LANSING,
June 2, 1887.

President Chamberlain called the meeting to order at 8:30 A. M.

Mr. Fralick moved that the invitation of the Board of Agriculture to visit the College Farm be accepted and the committee go to the Farm in a body.

Carried.

Upon motion of Mr. Wood the same privileges were extended to the Crop correspondents as last year.

The President appointed Col. Shoemaker a member of Transportation Committee in place of Mr. Cobb.

On motion adjourned.

WM. CHAMBERLAIN,
President.

J. C. STERLING,
Secretary.

MINUTES OF MEETINGS DURING FAIR HELD SEPTEMBER 19–23, 1887.

HIBBARD HOUSE, JACKSON,
Monday Evening, September 19, 1887.

The Executive Committee met at 7:30 o'clock, P. M.

President Chamberlain in the chair.

Present—President Chamberlain, Treasurer Dean, Messrs. Rising, Ball, Hanford, Lessiter, Sharp, Hyde, Reed, Smith, Burrington, Wood, Shoemaker, J. P., Shoemaker, M., Howard, Young, Butterfield, Anderson, Wells, Phillips, Fralick and the Secretary.

Superintendent Reed, of Division J, reported that Messrs. Austin, Tomlinson and Webster asked for attendants' tickets for their band. Mr. Reed asked for instructions.

Upon motion of Col. Shoemaker, Superintendent Reed was requested to issue tickets for the band.

Mr. Ball asked that Mr. Fisher, of the Jackson Ice Co., be allowed to deliver ice on the Fair grounds, the same as last year; granted.

Prof. Kimball asked the committee to admit school children to the Fair at a reduced rate.

On motion referred to the Treasurer with power.

Moved and supported that the annual election be held on the Fair grounds, in the building now occupied by the Secretary of State. The motion prevailed, and Messrs. L. D. Watkins, of Manchester, W. S. Wilcox, of Adrian and Henry Chamberlain, of Three Oaks, were duly elected judges of election.

On motion adjourned.

WM. CHAMBERLAIN,
President.

J. C. STERLING,
Secretary.

HIBBARD HOUSE, JACKSON,
Tuesday Evening, September 20, 1887.

The Executive Committee met at 7:30 P. M.

President Chamberlain in the chair.

Roll called: Present, President Chamberlain, Treasurer Dean, Messrs. Rising, Hanford, Ball, Lessiter, Sharp, Hyde, Reed, Smith, Burrington, Wood, Turner, Shoemaker, J. P., Shoemaker, M., Howard, Young, Butterfield, Gilbert, Anderson, Wells, Phillips, Fralick and the Secretary.

Treasurer Dean reported gate receipts for Monday and Tuesday, $702.50.

The Secretary reported an entry from Mr. Wright Hawkins, received after time named for entries to close.

Upon motion it was voted that Mr. Hawkins be granted all the privileges of other exhibitors, save the right to compete for premiums.

Messrs. Baxter, Shoemaker, M., and Butterfield were appointed a committee to draft suitable resolutions upon the death of Messrs. James Bailey and G. W. Griggs, ex-Presidents of the Society.

A protest of Messrs. Farrell and Godfrey, against the stallion "Young Contest" as not being a registered horse, was read and upon motion tabled.

Superintendent Howard stated that Messrs. Dunham and Wooden, of Concord, Mich., had entered a lot of Lincoln sheep in his department, and that this breed of sheep were not named in the premium list.

Mr. Butterfield moved that the sheep be considered ineligible to entry. Carried.

Adjourned.

WM. CHAMBERLAIN,
President.

J. C. STERLING,
Secretary.

JACKSON, *September 20, 1887.*

Pursuant to published notice, the annual caucus of the Society was held at the Hibbard House this evening. Mr. Wm. Chamberlain was chosen Chairman and J. C. Sterling elected Secretary.

It was moved and supported that the Chairman appoint a Committee on Nominations to consist of one member from each Congressional District, or as nearly as practicable. Carried.

The Chair appointed as such Committee Messrs. Henry Gale, W. J. Baxter, Michael Shoemaker, Henry Chamberlain, Henry Fralick, James M. Turner, I. H. Butterfield, J. P. Shoemaker, Samuel Johnson, Eugene Fifield, and Wm. McCreery.

The Committee reported, nominating Hon. Franklin Wells for President. Mr. Wells declined and upon motion the report was recommitted to the Committee.

The Committee then reported the following nominations:

For President, A. O. Hyde, Marshall; for Treasurer, A. J. Dean, Adrian; for Secretary, Joe. C. Sterling, Monroe; for members of the Executive Commiteee, M. J. Gard, Volinia; D. W. Howard, Pentwater; H. O. Hanford, Plymouth; Eugene Fifield, Bay City; A. F. Wood, Mason; Franklin Wells, Constantine; J. Q. A. Burrington, Tuscola; M. P. Anderson, Midland; L. D. Watkins, Manchester; C. W. Young, Paw Paw.

The report was accepted and adopted.

WM. CHAMBERLAIN,
President.

J. C. STERLING,
Secretary.

HIBBARD HOUSE, JACKSON,
Wednesday Eve., September 21, 1887.

The Executive Committee met at 7:30 P. M., President Chamberlain presiding. Roll called; quorum present.

The Farrell and Godfrey protest was upon motion taken from the table and referred to Supt. Phillips to report to the Winter Meeting.

Two protests of Dr. Hagadorn against horses entered in Class 14 by Messrs. A. E. Sutton and H. H. Keeler were read, and upon motion referred to Supt. Phillips.

Adjourned.

WM. CHAMBERLAIN,
President.

J. C. STERLING,
Secretary.

HIBBARD HOUSE, JACKSON,
Thursday Evening, September 22, 1887.

Committee met at 7:30 P. M.

President Chamberlain in the chair.

Roll called; quorum present.

Treasurer Dean reported gate receipts, $3,000.00.

The report of the judges of election was read as follows:

We the undersigned, judges of the annual election of the Michigan State Agricultural Society held on the Fair grounds in the city of Jackson this 22d day of September, A. D. 1887, do hereby certify that the whole number of votes cast for the office of President was fifty-six (56) votes, of which A. O. Hyde, of Marshall, received fifty-six. The whole number of votes cast for the office of Treasurer was fifty-six (56), of which A. J. Dean, of Adrian, received fifty-six. The whole number of votes cast for the office of Secretary was fifty-six (56), of which J. C. Sterling, of Monroe, received fifty-six. The whole number of votes cast for members of the Executive Committee was five hundred and sixty, of which

M. J. Gard, of Volinia, received	56
D. W. Howard, of Pentwater, received	56
H. O. Hanford, of Plymouth, received	56
Eugene Fifield, of Bay City, received	56
A. F. Wood, of Mason, received	56

Franklin Wells, of Constantine, received	56
J. Q. A. Burrington, of Tuscola, received	56
M. P. Anderson, of Midland, received	56
L. D. Watkins, of Manchester, received	56
C. W. Young, of Paw Paw received	53
Michael Shoemaker, of Jackson, received	3

The President, Treasurer, Secretary and first ten members of the Executive Committee named, were declared elected.

(Signed)

FRANK LITTLE,
JAMES R. WARNER,
ROBERT L. HEWITT,
Judges of Election.

WM. CHAMBERLAIN,
President.

Report accepted and ordered placed on file.

Superintendent Phillips reported that the protests of Dr. Hagadorn had been withdrawn.

On motion adjourned.

WM. CHAMBERLAIN,
President.

J. C. STERLING,
Secretary.

HIBBARD HOUSE, JACKSON,
Friday Evening, September 23, 1887.

The Executive Committee met at 7:30 P. M., President Chamberlain presiding. Quorum present.

Treasurer Dean reported total gate receipts, $13,806.05.

Chairman Hyde reported receipts from booth and ground rent, $2,124.05.

REPORTS OF DIVISION SUPERINTENDENTS.

Supt. Butterfield, Division A, Cattle, reported regular premiums awarded $2,907.00.

Supt. Phillips, Division B, Horses, reported regular premiums awarded $2,448.00.

Supt. Howard, Division C, Sheep, reported regular premiums awarded $1,505.00.

Supt. Lessiter, Division D, Swine, reported regular premiums awarded $732.00 and six diplomas.

Supt. Burrington, Division E, Poultry, reported regular premiums awarded $146.50.

Supt. Wood, Division F, Agricultural, reported regular premiums awarded $346.50; discretionary premiums recommended $2.00; total $346.50.

Supt. Shoemaker, Division G, Dairy, reported regular premiums awarded $114.50; discretionary premiums recommended $6.50; total $121.00.

Supt. Smith, Division H, Bees and Honey, reported regular premiums awarded $266.00.

Supt. Young, Division I, Implements, and Supt. Gilbert, Division K, Machinery, reported fine exhibits. No premiums awarded.

Supt. Fralick, Division L, Manufactured Goods, reported regular premiums awarded $228.00 and two diplomas; discretionary premiums recommended $3.00; total $231.00 and two diplomas.

Supt. Anderson, Division M, Musical Instruments, etc., reported a discretionary premium of $2.00 recommended.

Supt. Baxter, Division N, Art, reported regular premiums awarded $623.00; discretionary premiums recommended $55.00; total $678.00.

Supt. Anderson, Division O, Needlework, and Q, Children's Work, reported for Division O: regular premiums awarded $226.00; discretionary premiums recommended $8.00; total $234.00. For Division Q: regular premiums awarded $21.00; discretionary premiums recommended $4.00; total $25.00.

Supt. Wells, Division P, Miscellaneous, reported regular premiums awarded $6.00, one diploma and one medal.

Upon motion the reports with recommendations were accepted and adopted.

A protest of Mr. E. Turner against Mr. Peter Hagle's horses was read and upon motion referred to Supt. Phillips.

The following communications were then read by the Secretary:

Hon. Wm. Chamberlain, President Michigan State Agricultural Society:

DEAR SIR—I have the honor to report that this Department has, during the Fair, maintained an office in the building assigned it, near the main entrance to the grounds.

The number of tickets received from Treasurer Dean was	201
Number issued	186
Number returned	15

For the courtesy extended by the Society, please accept the sincere thanks of myself and also of the crop correspondents.

Very Respectfully,

FRANCIS B. EGAN,
Deputy Secretary of State.

JACKSON, September 23, 1887.

Accepted and placed on file.

Jos. C. Sterling, Secretary State Agricultural Society:

DEAR SIR—I have the honor to acknowledge courtesies extended by your Association to the Michigan Weather Service.

Allow me to thank you for the favors shown me while on the grounds.

Very Respectfully,

N. B. CONGER,
Ag't Sig. Corps and Director.

JACKSON, Sept. 23, 1887.

Accepted and placed on file.

The Secretary read several letters from Mr. G. N. Hatch, relative to his stallion, Hambletonian Gift, and stated that Mr. Hatch had not furnished proof that the stallion was standard at the time of the last State Fair.

Upon motion, Mr. Hatch was given until the next Winter meeting to furnish such proof.

On motion the Committee adjourned.

WM. CHAMBERLAIN,
President.

J. C. STERLING,
Secretary.

OFFICIAL LIST OF PREMIUMS AWARDED AT THE THIRTY-NINTH ANNUAL FAIR OF THE MICHIGAN STATE AGRICULTURAL SOCIETY, HELD AT JACKSON SEPTEMBER 19 TO 23, 1887.

DIVISION A—CATTLE.

CLASS 1—SHORTHORNS.

Best bull, 3 years years old or over, John Lessiter, Jersey, Mich	$20 00
2d do., Frank Merritt, Charlotte	15 00
3d do., James Conley, Marshall	10 00
Best bull, 2 years old, Guy Henning, Wheatfield	20 00
2d do., B. F. Batchelor, Osceola Center	15 00
3d do., A. P. Cook, Brooklyn	10 00
Best bull, 1 year old, James M. Turner, Lansing	15 00
2d do., James Conley, Marshall	10 00
3d do., F. N. Green, Olivet	5 00
Best bull calf, under 1 year, John Lessiter, Jersey	12 00
2d do., H. C. Easterly, Marshall	8 00
3d do., A. P. Cook, Brooklyn	5 00
Best cow, 4 years old or over, John Lessiter, Jersey	20 00
2d do., J. M. Turner, Lansing	15 00
3d do., B. F. Batchelor, Osceola Center	10 00
Best cow, 3 years old, J. M. Turner, Lansing	20 00
2d do., John C. Sharp, Jackson	15 00
3d do., John Lessiter, Jersey	10 00
Best heifer, 2 years old, James M. Turner, Lansing	20 00
2d do., John Lessiter, Jersey	15 00
3d do., J. M. Turner, Lansing	10 00
Best yearling heifer, Jas. Conley, Marshall	15 00
2d do., James M. Turner, Lansing	10 00
3d do., James M. Turner, Lansing	5 00
Best heifer calf, John Lessiter, Jersey	12 00
2d do., B. F. Batchelor, Osceola Center	8 00
3d do., James M. Turner, Lansing	5 00
Best herd of Shorthorns, John Lessiter, Jersey	35 00
2d do., J. M. Turner, Lansing	25 00
3d do., J. C. Sharp, Jackson	20 00

THEODORE HUSTON, *Judge.*

CLASS 2—DEVONS.

Best bull, 3 years old or over, W. S. Walker, Utica	$20 00
2d do., E. T. Doney, Jackson	15 00
3d do., E. T. Doney, Jackson	10 00
Best bull, 2 years old, E. T. Doney, Jackson	20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., H. L. Carrier, Brookfield	10 00
Best bull calf, under 1 year, R. G. Hart, Lapeer	12 00
2d do., E. T. Doney, Jackson	8 00
Best cow, 4 years old or over, W. S. Walker, Utica	20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., H. L. Carrier, Brookfield	10 00

Best cow, 3 years old, H. L. Carrier, Brookfield	$20 00
2d do., W. S. Walker, Utica	15 00
3d do., R. G. Hart, Lapeer	10 00
Best heifer, 2 years old, W. S. Walker, Utica	20 00
2d do., W. S. Walker, Utica	15 00
3d do., R. G. Hart, Lapeer	10 00
Best heifer, 1 year old, W. S. Walker, Utica	15 00
2d do., E. T. Doney, Jackson	10 00
3d do., H. L. Carrier, Brookfield	5 00
Best heifer, under 1 year, H. L. Carrier, Brookfield	12 00
2d do., W. S. Walker, Utica	8 00
3d do., W. S. Walker, Utica	5 00
Best herd of Devons, W. S. Walker, Utica	35 00
2d do., R. G. Hart, Lapeer	25 00
3d do., H. L. Carrier, Brookfield	20 00

F. H. JOHNSON, *Judge*,
South Bend, Ind.

CLASS 3—HEREFORDS.

Best bull, 3 years old or over, Merrill & Fifield, Bay City	$20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., Guy Henning, Wheatfield	10 00
Best bull, 2 years old, Sotham & Stickney, Pontiac	20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., E. Driggs, Palmyra	10 00
Best bull, 1 year old, Merrill & Fifield, Bay City	15 00
2d do., E. Driggs, Palmyra	10 00
3d do., Sotham & Stickney, Pontiac	5 00
Best bull calf, under 1 year old, Merrill & Fifield, Bay City	12 00
2d do., Jas. M. Turner, Lansing	8 00
3d do., Jas. M. Turner, Lansing	5 00
Best cow, 4 years old or over, Merrill & Fifield, Bay City	20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., Jas. M. Turner, Lansing	10 00
Best cow, 3 years old, Merrill & Fifield, Bay City	20 00
2d do., Sotham & Stickney, Pontiac	15 00
3d do., Merrill & Fifield, Bay City	10 00
Best heifer, 2 years old, Jas. M. Turner, Lansing	20 00
2d do., Sotham & Stickney, Pontiac	15 00
3d do., Guy Henning, Wheatfield	10 00
Best yearling heifer, Merrill & Fifield, Bay City	15 00
2d do., Sotham & Stickney, Pontiac	10 00
3d do., James M. Turner, Lansing	5 00
Best heifer calf, under 1 year old, Merrill & Fifield, Bay City	12 00
2d do., James M. Turner, Lansing	8 00
3d do., Guy Henning, Wheatfield	5 00
Best herd of Herefords, Merrill & Fifield, Bay City	35 00
2d do., Sotham & Stickney, Pontiac	25 00
3d do., James M. Turner, Lansing	20 00

F. H. JOHNSON, *Judge*.

CLASS 4—JERSEYS.

Best bull, 3 years old or over, H. R. Kingman, Battle Creek	$20 00
2d do., G. B. & C. S. Smith, Eagle	15 00
3d do., J. H. Fonda, Mendon	10 00
Best bull, 2 years old, Anderson Bros., Midland	20 00
2d do., H. R. Kingman, Battle Creek	15 00
3d do., W. R. Montgomery, Jr., Hillsdale	10 00
Best bull, 1 year old, H. R. Kingman, Battle Creek	15 00
2d do., G. B. & C. S. Smith, Eagle	10 00
Best bull calf, G. B. & C. S. Smith, Eagle	12 00
Best cow, 4 years old or over, G. B. & C. S. Smith, Eagle	20 00
2d do., H. R. Kingman, Battle Creek	15 00
3d do., G. B. & C. S. Smith, Eagle	10 00

Best cow, 3 years old, G. B. & C. S. Smith, Eagle	$20 00
2d do., H. R. Kingman, Battle Creek	15 00
3d do., W. R. Montgomery, Jr., Hillsdale	10 00
Best heifer, 2 years old, W. R. Montgomery, Jr., Hillsdale	20 00
2d do., G. B. & C. S. Smith, Eagle	15 00
3d do., H. R. Kingman, Battle Creek	10 00
Best heifer, 1 year old, W. R. Montgomery, Jr., Hillsdale	15 00
2d do., G. B. & C. S. Smith, Eagle	10 00
3d do., H. R. Kingman, Battle Creek	5 00
Best heifer calf, W. R. Montgomery, Jr., Hillsdale	12 00
2d do., H. R. Kingman, Battle Creek	8 00
3d do., G. B. & C. S. Smith, Eagle	5 00
Best herd of Jerseys, H. R. Kingman, Battle Creek	35 00
2d do., G. B. & C. S. Smith, Eagle	25 00
3d do., W. R. Montgomery, Jr., Hillsdale	20 00

Special prize of the American Jersey Cattle Club—Best herd, H. R. Kingman, Battle Creek. $100.

F. L. GASTON, *Judge.*

CLASS 5—GALLOWAYS AND POLLED ANGUS.

Best bull, three years old or over, W. P. Darrow, Jefferson	$20 00
2d do., S. J. Murphy, Detroit	15 00
3d do., C. W. & L. P. Tubbs, Kalamo	10 00
Best bull, 2 years old, R. G. Hart, Lapeer	20 00
2d do., W, P. Darrow, Jefferson	15 00
3d do., S. J. Murphy, Detroit	10 00
Best bull 1 year old, S. J. Murphy, Detroit	15 00
2d do., C. W. & L. P. Tubbs, Kalamo	10 00
3d do., C. W. & L. P. Tubbs, Kalamo	5 00
Best bull calf, S. J. Murphy, Detroit	12 00
2d do., S. J. Murphy Detroit	8 00
3d do., W. P. Darrow, Jefferson	5 00
Best cow, 4 years old or over, R. G. Hart, Lapeer	20 00
2d do., W. P. Darrow, Jefferson	15 00
3d do., R. G. Hart, Lapeer	10 00
Best cow, 3 years old, R. G. Hart, Lapeer	20 00
2d do., W. P. Darrow. Jefferson	15 00
3d do., S. J. Murphy, Detroit	10 00
Best heifer, 2 years old, W. P. Darrow, Jefferson	20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., S. J. Murphy, Detroit	10 00
Best heifer, 1 year old, S. J. Murphy, Detroit	15 00
2d do., W. P. Darrow, Jefferson	10 00
3d do., S. J. Murphy, Detroit	5 00
Best heifer calf, S. J. Murphy, Detroit	12 00
2d do., R. G. Hart, Lapeer	8 00
3d do., W. P. Darrow, Jefferson	5 00
Best herd of Galloways or Polled Angus, R. G. Hart, Lapeer	35 00
2d do., W. P. Darrow, Jefferson	25 00
3d do., S. J. Murphy, Detroit	20 00

J. A. MANN, *Judge.*

CLASS 6—HOLSTEIN-FRIESIAN.

Best bull, 3 years old or over, C. V. Seeley, N. Farmington	$20 00
2d do., W. K. Sexton, Howell	15 00
3d do., A. E. Riley, Walled Lake	10 00
Best bull, two years old, Tousey & Seeley, Pontiac	20 00
2d do., L. W. Simmons, Northville	15 00
3d do., Mills Bros., Ann Arbor	10 00
Best bull, 1 year old, J. V. Seeley & Son, N. Farmington	15 00
2d do., J. W. Harris, Pinckney	10 00
3d do., J. W. Saliard, Romeo	5 00
Best bull calf, Tousey & Seeley, Pontiac	12 00
2d do., L. W. Simmons, Northville	8 00
3d do., W. K. Sexton, Howell	5 00

Best cow, 4 years old or over, W. K. Sexton, Howell	$20 00
2d do., W. K. Sexton, Howell	15 00
3d do., C. V. Seeley, N. Farmington	10 00
Best cow, 3 years old, Tousey & Seeley, Pontiac	20 00
2d do., F. D. Whitbeck, Saranac	15 00
3d do., J. W. Saliard, Romeo	10 00
Best heifer, 2 years old, Tousey & Seeley, Pontiac	20 00
2d do., Tousey & Seeley, Pontiac	15 00
3d do., A. E. Riley, Walled Lake	10 00
Best heifer, 1 year old, Tousey & Seeley, Pontiac	15 00
2d do., W. K. Sexton, Howell	10 00
3d do., Mills Bros., Ann Arbor	5 00
Best heifer calf, C. V. Seeley, N. Farmington	12 00
2d do., A. E. Riley, Walled Lake	8 00
3d do., Wm. K. Sexton, Howell	5 00
Best herd of Holstein-Friesians, Tousey & Seeley, Pontiac	35 00
2d do., W. K. Sexton, Howell	25 00
3d do., A. E. Riley, Walled Lake	20 00

J. A. MANN.
E. R. PHILLIPS,
W. J. G. DEAN,
Judges.

CLASS 7—GRADE CATTLE.

Best cow, 4 years old or over, A. P. Cook, Brooklyn	$20 00
2d do., John C. Sharp, Jackson	15 00
3d do., R. A Remick, Clarkston	10 00
Best cow, 3 years old, David Miller, Clarkston	20 00
2d do., R. A. Remick, Clarkston	15 00
3d do., R. A. Remick, Clarkston	10 00
Best heifer, 2 years old, J. M. Turner, Lansing	20 00
2d do., R. A. Remick, Clarkston	15 00
3d do., David Miller, Clarkston	10 00
Best heifer, 1 year old, H. H. Hinds, Stanton	15 00
2d do.. A. P. Cook, Brooklyn	10 00
3d do., H. H. Hinds, Stanton	5 00
Best heifer calf, J. C. Sharp, Jackson	12 00
2d do., Howard Chapman, Somerset	8 00
3d do., F. A. Townley, Tompkins	5 00
Best milch cow, John Chilson, Hanover	15 00
2d do., H. H. Hinds, Stanton	10 00

THEODORE HUSTON, *Judge.*

CLASS 8—FAT CATTLE.

Best steer, 3 years old, H. H. Hinds, Stanton	$20 00
2d do., H. H. Hinds, Stanton	15 00
3d do., H. M. Morse, Union City	10 00
Best steer, 2 years old, F. H. Smith, Somerset	20 00
2d do., H. H. Hinds, Stanton	15 00
3d do., F. H. Smith, Somerset	10 00
Best steer, 1 year old, F. A. Townley, Tompkins	15 00
2d do.. F. N. Green, Olivet	10 00
3d do., E. T. Doney, Jackson	5 00
Best calf, F. A. Townley, Tompkins	15 00
2d do., R. G. Hart, Lapeer	10 00
3d do., E. T. Doney, Jackson	5 00
Best herd of 5 fat cattle, H. H. Hinds, Stanton	30 00
2d do., F. H. Smith, Somerset	20 00
3d do., E. T. Doney, Jackson	10 00

Best steer, 3 years old, showing greatest weight for age in days, H. H. Hinds, Stanton, $15. Age, 1,214 days; weight, 1,820 lbs.; gain per day, 1.50.

Best steer, two years old, showing greatest weight for age in days, H. H. Hinds, Stanton $15. Age 1,077 days; weight, 1,630 lbs.; gain per day, 1.47.

Best steer, 1 year old, showing greatest weight for age in days, F. A. Townley, Tompkins, $15. Age, 483 days; weight, 1,110 lbs.; gain per day, 2.30.

THEODORE HUSTON, *Judge.*

DIVISION B—HORSES.

CLASS 9—CLEVELAND BAYS OR OTHER COACH HORSES.

Best stallion 4 years old or over, John Powers, Homer	$20 00
2d do., Uri Isbell, Stockbridge	15 00
Best stallion 3 years old, Cleveland Bay Horse Association, Paw Paw	20 00
2d do., Pomeroy Van Riper, Onondaga	15 00

O. J. SMITH,
H. N. BIDLEMAN,
G. N. HATCH,
Judges.

CLASS 10—THOROUGHBREDS.

Best stallion, 4 years old or over, Geo. W. Phillips, Jr., Romeo	$20 00
2d do., P. H. Hagle, Pontiac	15 00
Best stallion, 3 years old, E. Turner, Bronson	20 00
Best stallion colt, J. W. Hicks, Horton	7 00
Best mare 4 years old or over, F. B. True, Rives Junction	15 00
2d do., Peter H. Hagle, Pontiac	12 00
Best mare, 3 years old or over, P. H. Hagle, Pontiac	12 00

B. D. TAGGERT,
S. A. COLBY,
JAMES DAVIDSON,
Judges.

CLASS 11—HORSES OF ALL WORK.

Best stallion, 4 years old or over, Chas. Koernig, Bridgewater	$20 00
2d do., Charles Travis, St. Johns	15 00
3d do., R. G. Johnson, Moscow	10 00
Best stallion, 3 years old, Joseph K. Moss, Grand Ledge	20 00
2d do., J. E. Davidson. Armada	15 00
3 do., David Chapel, Parma	10 00
Best stallion, 2 years old, Cleveland Bay Horse Association, Paw Paw	12 00
2d do., Charles Keornig, Bridgewater	10 00
3d do., O. W. Stevens, Devereaux	8 00
Best stallion, 1 year old, Nelson Eldred, Battle Creek	10 00
2d do., Fred Schutt, Arland	8 00
Best stallion colt, Nelson Eldred, Battle Creek	8 00
2d do., M. M. Kennedy, Liberty	5 00
3d do., Will N. Adams, Jackson	3 00
Best brood mare, 4 years old or over, with foal by side, Farrell & Godfrey, Parma	20 00
2d do., George B. King, Parma	15 00
2d do., Nelson Eldred, Battle Creek	10 00
Best mare, 3 years old, Cleveland Bay Horse Association, Paw Paw	10 00
2d do., E. W. Campbell, Parma	8 00
3d do., Thomas Maxwell, Lawton	4 00
Best mare, 2 years old, J. B. Stoddard, Concord	8 00
2d do., John Chilson, Hanover	5 00
3d do., L. C. Field, Mendon	3 00
Best mare, 1 year old, M. H. Ashley, Homer	7 00
2d do., Charles Travis, St. Johns	5 00
3d do., Charles Travis, St. Johns	3 00
Best filly colt, M. M. Kennedy, Liberty	5 00
2d do., John Powers, Homer	3 00
3d do., M. M. Kennedy, Liberty	2 00
Best gelding, 5 years old or over, James C. Deyo, Jackson	15 00
2d do., Fred Lewis, Liberty	10 00
Best gelding, 4 years old, J. C. Deyo, Jackson	12 00
2d do., H. D. Hewes, Grass Lake	8 00
Best gelding, 3 years old, W. S. Harris, Homer	10 00
2d do., E. W. Campbell, Parma	8 00
3d do., W. N. Adams, Jackson	5 00

Best gelding, 2 years old, L. C. Field, Mendon	$8 00
2d do., J. H. Hendee, Jackson	5 00
3d do., Robert Gould & Son, Ceresco	3 00
Best gelding, 1 year old, J. S. Geiger, Springport	6 00
2d do., J. S. Geiger, Springport	4 00
3d do., Milford Harmon, Jackson	2 00
Best pair of matched horses, 5 years old or over, J. C. Deyo, Jackson	25 00
Best pair matched horses, 4 years old or over, J. C. Deyo, Jackson	20 00
2d do., A. O. Parmenter, Grand Ledge	12 00
3d do., Thos. Maxwell, Lawton	8 00

O. J. SMITH,
S. A. COLBY,
H. N. BIDELMAN,
Judges.

CLASS 12—ROADSTERS.

Best stallion, 5 years old or over, Dr. W. A. Gibson, Jackson	$25 00
2d do., Henry Brown, Battle Creek	20 00
3d do., R. G. Hart, Lapeer	10 00
Best stallion, 4 years old, W. H. Schautz, Hastings	20 00
2d do., R. G. Hart, Lapeer	15 00
3d do., Dr. Henry Haynes, Jackson	10 00
Best stallion, 3 years old, J. C. Deyo, Jackson	20 00
Best mare or gelding, 5 years old or over, B. D. Taggart, Romeo	15 00
2d do., A. L. Smith, Girard	10 00
3d do., J. C. Deyo, Jackson	5 00
Best mare or gelding, 4 years old, Geo. Stephens, Tompkins Center	12 00
2d do., Horace King, Parma	8 00
Best mare or gelding, 3 years old, J. C. Deyo, Jackson	10 00
2d do., M. H. Ray, Concord	6 00
3d do., J. B. Stoddard, Concord	4 00

O. J. SMITH,
H. N. BIDLEMAN,
S. A. COLBY,
Judges.

CLASS 13—BREEDERS' STOCK.

Best stallion, 2 years old, H. H. Tucker, Concord	$12 00
2d do., A. H. Laverty, Sandstone	8 00
3d do., Wellington & Ludlow, Springport	5 00
Best stallion, 1 year old, Robert Gould & Son, Ceresco	10 00
2d do., H. B. Elliott, Arland	6 00
3d do., D. C. McCauley, Henrietta	4 00
Best stallion colt, Geo. B. King, Parma	7 00
2d do., W. N. Adams, Jackson	5 00
3d do., J. C. Deyo, Jackson	3 00
Best brood mare, 4 years old or over, with foal by side, A. L. Smith, Girard	20 00
2d do., J. C. Deyo, Jackson	15 00
3d do., W. A. Higgins, Jackson	10 00
Best mare, 2 years old, Geo. B. King, Parma	8 00
2d do., Wellington & Ludlow, Springport	5 00
Best mare, 1 year old, Farrell & Godfrey, Parma	7 00
2d do., L. C. Field, Mendon	5 00
3d do., G. N. Hatch, Horton	2 00
Best filly colt, A. L. Smith, Girard	5 00
2d do., Robert Gould & Son, Ceresco	3 00
3d do., Walter Higgins, Jackson	2 00

W. W. HODGE,
JAMES E. DAVIDSON,
Judges.

CLASS 14—GENTS' DRIVING HORSES TO ROAD WAGONS.

Best pair of driving horses, J. C. Deyo, Jackson	$20 00
Best single horse, 5 years old or over, A. E. Sutton, Jackson	20 00
2d do., H. H. Keeler, Jackson	15 00
3d do., Dr. J. W. Hagadorn, Lansing	10 00

Best single horse, 4 years old, A. L. Smith, Girard	$20 00
2d do., H. L. Merriman, Jackson	15 00

JAMES DAVIDSON,
S. A. COLBY,
Judges.

CLASS 15—CLYDESDALE AND ENGLISH SHIRE HORSES.

Best stallion, 4 years old or over, Mills & Hyslop, Bancroft	$20 00
2d do., C. E. Lockwood, Washington (protested)	15 00
3d do., Farrell & Godfrey, Parma	10 00
Best stallion, 2 years old, Wm. Hyslop, Washington	10 00
2d do., A Phillips, Dansville	6 00
Best stallion, 1 year old, J. M. Turner Lansing	8 00
2d do., Wm. Hyslop, Washington	5 00
3d do., J. M. Turner. Lansing	3 00
Best stallion colt, James M. Turner, Lansing	5 00
Best mare, 4 years old or over, James M. Turner, Lansing	15 00
2d do., James M. Turner	12 00
3d do., A. Phillips, Dansville	8 00
Best mare, 2 years old, James M. Turner, Lansing	10 00
Best filly colt, James M. Turner, Lansing	5 00
2d do., James M. Turner, Lansing	3 00
3d do., A. Phillips, Dansville	2 00

AMERICAN CLYDESDALE ASSOCIATION SPECIAL PRIZE.

Best Clydesdale stallion bred in Michigan, J. M. Turner, Lansing, gold medal.
Best Clydesdale mare bred in Michigan, J. M. Turner, Lansing, gold medal.

B. D. TAGGART,
S. A. COLBY,
JAMES DAVIDSON,
Judges.

CLASS 16—NORMAN PERCHERON AND OTHER FRENCH DRAFT HORSES.

Best stallion, 4 years old or over, R. G. Hart, Lapeer	$20 00
2d do., Eli Fisk, Tompkins Center	15 00
Best stallion, 3 years old, D. D. Raymond, Dansville	20 00
2d do., W. F. Willard, Ferrysburg	12 00
3d do., James Seagraves, Eaton Rapids	8 00
Best mare, 2 years old, R. G. Hart, Lapeer	10 00

H. N. BIDELMAN,
O. J. SMITH,
Judges.

CLASS 17—DRAFT HORSES NOT REGISTERED.

Best pair, 4 years old or over, Shedden Co., Jackson	$20 00
Best pair 3 years old, J. Woodbeck, Armada	15 00
Best mare, 4 years old or over, A. Phillips, Dansville	15 00
2d do., James M. Turner, Lansing	12 00
3d do., James M. Turner, Lansing	8 00
Best mare, 3 years old, A. Phillips, Danville	12 00
2d do., James M. Turner, Lansing	8 00
Best mare or gelding, 2 years old, James M. Turner, Lansing	10 00
2d do., C. E. Lockwood, Washington	6 00
3d do., D. D. Raymond, Dansville	4 00
Best mare or gelding, 1 year old, F. A. King & Son, Parma	8 00
2d do., James M. Turner, Lansing	5 00
3d do., James M. Turner, Lansing	3 00
Best colt, James M. Turner, Lansing	5 00

O. J. SMITH,
G. N. HATCH,
H. N. BIDELMAN,
Judges.

CLASS 18—CARRIAGE AND BUGGY HORSES.

Best pair matched carriage horses, 16 hands or over, five years old or over, J. C. Deyo, Jackson	$25 00
2d do., Philo J. Hall, Jackson	15 00
3d do., D. B. Hibbard, Jackson	10 00
Best pair matched carriage horses 16 hands or over and four years old, Jerome Graves, Albion	25 00
Best pair matched carriage horses under 16 hands and 4 years old or over, Israel Wicks, Jonesville	25 00
2d do., Jacob Hosner, Romeo	15 00
3d do., Henry Hayden, Jackson	10 00
Best pair matched carriage horses, 3 years old, R. Gould & Son, Ceresco	20 00
Best single carriage or buggy horse, four years old or over, Mrs. S. A. Cooley, Jackson	12 00
2d do., S. A. Colby, Romeo	8 00
3d do., A. E. Sutton, Jackson	4 00
Best single carriage or buggy horse, 3 years old, A. O. DeBois, Mason	10 00
2d do., J. C. Deyo, Jackson	7 00
3d do., M. H. Ray, Concord	3 00

JAMES DAVIDSON,
H. N. BIDELMAN,
B. D. TAGGART,
Judges.

CLASS 19—ROADSTER STALLIONS, STANDARD BRED.

Best stallion, 5 years old or over, Dr. W. A. Gibson, Jackson	$60 00
Best stallion 4 years old, J. D. Shurtz, Bronson	50 00
2d do., A. T. Short, Coldwater	35 00
3d do., Bissel & Archer, Leslie	20 00
Best stallion, 3 years old, G. N. Hatch, Horton	30 00
2d do., Burton Hatch, Horton	20 00
3d do., H. H. Tucker, Concord	10 00
Best stallion, 2 years old, Benjamin Buel, Bronson	20 00
2d do., G. N. Hatch, Horton	15 00
3d do., E. C. Hill, Battle Creek	10 00

O. J. SMITH,
S. A. COLBY,
B. D. TAGGART,
Judges.

CLASS 20—ROADSTER MARES AND GELDINGS, STANDARD BRED.

Best mare or gelding, 5 years old or over, John C. Blake, Tekonsha	$60 00
2d do., G. N. Hatch, Horton	40 00
3d do., W. F. Willard, Ferrysburg	20 00
Best mare or gelding, 4 years old, D. B. Hibbard, Jackson	50 00
2d do., J. D. Shurtz, Bronson	35 00
3d do., F. W. Dickey, Marshall	20 00
Best mare or gelding, 2 years old, Clifton Short, Bronson	20 00
2d do., D. B. Hibbard, Jackson	15 00
3d do., L. C. Field, Mendon	10 00

B. D. TAGGART,
S. A. COLBY,
Judges.

CLASS 21—THOROUGHBRED STALLIONS, MARES AND GELDINGS, UNDER SADDLE.

Best stallion, any age, J. & F. Ames, Eaton Rapids	$60 00
2d do., Wm. Imerson, Caro	40 00
Best mare or gelding, any age, J. & F. Ames, Eaton Rapids	50 00
2d do., P. B. Baker, Jerome	30 00

B. D. TAGGART,
S. A. COLBY,
Judges.

CLASS 22—SWEEPSTAKES FOR STALLIONS WITH FIVE OF GET.

Best thoroughbred stallion, with 5 of get, Geo. W. Phillips, Jr., Romeo	$20 00
2d do., C. P. Hatch, Horton	15 00
Best all work stallion, with 5 of get, Charles Travis, St. Johns	20 00
Best roadster stallion, with 5 of get, Dr. W. A. Gibson, Jackson	20 00
2d do., Farrell & Godfrey, Parma	15 00
Best coach stallion, with 5 of get, John Powers, Homer	20 00
2d do., Dr. Henry Haynes, Jackson	15 00
Best Clydesdale or English draft stallion, with 5 of get, C. E. Lockwood, Washington, (protested)	20 00
2d do., A. Phillips, Dansville	15 00

O. J. SMITH,
JAMES DAVIDSON,
W. W. HODGE,
Judges.

DIVISION C—SHEEP.

CLASS 23—THOROUGHBRED AMERICAN MERINOS.

Best ram, 3 years old or over, J. S. Wood, Saline	$15 00
2d do., Allen & Fellows, Manchester	12 00
3d do., L. W. & O. Barnes, Byron	8 00
Best ram, 2 years old, J. S. Wood, Saline	15 00
2d do., R. W. Mills, Saline	12 00
3d do., C. M. Fellows, Manchester	8 00
Best ram, 1 year old, J. S. Wood, Saline	15 00
2d do., R. W. Mills, Saline	12 00
3d do., B. F. Batchelor, Osceola Center	8 00
Best ram lamb, W. & E. N. Ball, Hamburg	12 00
2d do., N. A. Wood, Saline	10 00
3d do., C. M. Fellows, Manchester	5 00
Best ewe, 3 years old or over, R. W. Mills, Saline	15 00
2d do., A. T. Short, Coldwater	12 00
3d do., Van Gieson Bros., Clinton	8 00
Best ewe, 2 years old, A. T. Short, Coldwater	15 00
2d do., W. & E. N. Ball, Hamburg	12 00
3d do., VanGieson Bros., Clinton	8 00
Best ewe, 1 year old, W. & E. N. Ball, Hamburg	15 00
2d do., A T. Short, Coldwater	12 00
3d do., R. W. Mills, Saline	8 00
Best ewe lamb, W. & E. N. Ball, Hamburg	12 00
2d do., A. Stow, Iosco	10 00
3d do., VanGieson Bros., Clinton	5 00

CHAS. E. SOUTHWELL,
T. V. QUACKENBUSH,
J. C. THOMPSON,
Judges.

CLASS 24—THOROUGHBRED AMERICAN MERINOS, BRED AND OWNED IN MICHIGAN.

Best ram, 2 years old or over, A. Stow, Iosco	$15 00
2d do., E. Kellogg, Osceola Center	12 00
3d do., N. A. Wood, Saline	8 00
Best ram, 1 year old, VanGieson Bros., Clinton	15 00
2d do., E. Kellogg, Osceola Center	12 00
3d do., J. W. Newberry, Hanover	8 00
Best ram lamb, E. Kellogg, Osceola Center	12 00
2d do., A. Stow, Iosco	10 00
3d do., J. W. Newberry, Hanover	5 00
Best ewe, 2 years old or over, A. Stow, Iosco	15 00
2d do., A. T. Short, Coldwater	12 00
3d do., W. & E. N. Ball, Hamburg	8 00
Best ewe, 1 year old, E. Kellogg, Osceola Center	15 00
2d do,, A. T. Short, Coldwater	12 00
3d do., W. & E. N. Ball, Hamburg	8 00

Best ewe lamb, A. Stow, Iosco	$12 00
2d do., W. & E. N. Ball, Hamburg	10 00
3d do., F. C. Wood, Saline	5 00

T. V. QUACKENBUSH,
J. C. THOMPSON,
J. E. SMITH,
Judges.

CLASS 25—FINE WOOL GRADES.

Best ewe, 3 years old or over, L. W. & O. Barnes, Byron	$10 00
2d do., L. W. & O. Barnes, Byron	6 00
3d do., R. W. Mills, Saline	4 00
Best ewe, 2 years old, L. W. & O. Barnes, Byron	10 00
2d do., L. W. & O. Barnes, Byron	6 00
3d do., Allen & Brown, Springport	4 00
Best ewe, 1 year old, L. W. & O. Barnes, Byron	10 00
2d do., R. W. Mills, Saline	6 00
3d do., Allen & Brown, Springport	4 00
Best ewe lamb, Allen & Brown, Springport	8 00
2d do., R. W. Mills, Saline	5 00
3d do., L. W. & O. Barnes, Byron	3 00

J. E. SMITH,
J. C. THOMPSON,
Judges.

CLASS 26—SOUTHDOWNS.

Best ram, 2 years old or over, J. F. Rundel, Birmingham	$15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., R. Conley, Marshall	6 00
Best ram, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., Mrs. Ann Newton, Pontiac	8 00
3d do., R. Conley, Marshall	5 00
Best ram lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., J. F. Rundel, Birmingham	6 00
3d do., R. Conley, Marshall	4 00
Best ewe, 2 years old or over, Mrs. Ann Newton, Pontiac	15 00
2d do., J. F. Rundel, Birmingham	10 00
Best ewe, 1 year old, Mrs. Ann Newton, Pontiac	12 00
Best ewe lamb, Mrs. Ann Newton, Pontiac	10 00

G. HOWARD,
J. W. SALIARD,
W. S. CURTIS,
Judges.

CLASS 27—SHROPSHIRES.

Best ram, 2 years old or over, J. F. Rundel, Birmingham	$15 00
2d do., John Milton, Marshall	10 00
3d do., James Walker, Jackson	6 00
Best ram, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., John Milton, Marshall	8 00
3d do., J. F. Rundel, Birmingham	5 00
Best ram lamb, J. F. Rundel, Birmingham	10 00
2d do., John Milton Marshall	6 00
3d do., Dunham & Wooden, Concord	4 00
Best ewe, 2 years old or over, J. F. Rundel, Birmingham	15 00
2d do., Turner & Crosby, Lansing	10 00
3d do., Montgomery & Westfall, Hillsdale	6 00
Best ewe, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., J. F. Rundel, Birmingham	8 00
3d do., R. R. Smith, Howell	5 00
Best ewe lamb, R. Conley, Marshall	10 00
2d do., J. F. Rundel, Birmingham	6 00
3d do., James Walker, Jackson	4 00

G. HOWARD,
W. S. CURTIS,
J. W. SALIARD,
Judges.

CLASS 28—HAMPSHIRES.

Best ram, 2 years old or over, Mrs. Ann Newton, Pontiac	$15 00
2d do., J. F. Rundel, Birmingham	10 00
3d do., Mrs. Ann Newton. Pontiac	6 00
Best ram, 1 year old, Mrs. Ann Newton, Pontiac	12 00
2d do., John Moriarty, Hudson	8 00
3d do., J. F. Rundel, Birmingham	5 00
Best ram lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., John Moriarty, Hudson	6 00
3d do., Mrs. Ann Newton, Pontiac	4 00
Best ewe, 2 years old or over, Mrs. Ann Newton, Pontiac	15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., J. F. Rundel, Birmingham	6 00
Best ewe, 1 year old, Mrs. Ann Newton, Pontiac	12 00
2d do., Mrs. Ann Newton, Pontiac	8 00
3d do., John Moriarty, Hudson	5 00
Best ewe lamb, John Moriarty, Hudson	10 00
2d do., Mrs. Ann Newton, Pontiac	6 00
3d do., John Moriarty, Hudson	4 00

G. HOWARD,
J. W. SALIARD,
Judges.

CLASS 29—OXFORDS.

Best ram, 2 years old or over, Frank Willson, Jackson	$15 00
2d do., C. A. Searing, Lyons	10 00
3d do., C. A. Searing, Lyons	6 00
Best ram, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., Frank Willson, Jackson	8 00
3d do., Frank Willson. Jackson	5 00
Best ram lamb, Frank Willson, Jackson	10 00
2d do., F. A. King & Son, Parma	6 00
3d do., Frank Willson, Jackson	4 00
Best ewe, 2 years old or over, Mrs. Ann Newton, Pontiac	15 00
2d do., Frank Willson, Jackson	10 00
3d do., Mrs. Ann Newton, Pontiac	6 00
Best ewe, 1 year old, F. A. King & Son, Parma	12 00
2d do., Frank Willson, Jackson	8 00
3d do., Mrs. Ann Newton, Pontiac	5 00
Best ewe lamb. C. A. Searing, Lyons	10 00
2d do., F. A. King & Son, Parma	6 00
3d do., Mrs. Ann Newton, Pontiac	4 00

G. HOWARD
W. S. CURTIS,
J. W. SALIARD,
Judges.

CLASS 30—COTSWOLDS.

Best ram, 2 years old or over, Frank Willson, Jackson	$15 00
2d do., Montgomery and Westfall, Hillsdale	10 00
Best ram, 1 year old, Frank Willson, Jackson	12 00
2d do., Montgomery & Westfall, Hillsdale	8 00
Best ram lamb, Montgomery & Westfall, Hillsdale	10 00
2d do., Frank Willson, Jackson	6 00
3d do., Montgomery & Westfall, Hillsdale	4 00
Best ewe, 2 years old or over, Mrs. Ann Newton, Pontiac	15 00
2d do., Montgomery & Westfall, Hillsdale	10 00
3d do., Montgomery & Westfall, Hillsdale	6 00
Best ewe, 1 year old, Frank Willson, Jackson	12 00
2d do., Montgomery & Westfall, Hillsdale	8 00
3d do., Frank Willson, Jackson	5 00
Best ewe lamb, Frank Willson, Jackson	10 00
2d do., Montgomery & Westfall, Hillsdale	6 00
3d do., Montgomery & Westfall, Hillsdale	4 00

G HOWARD,
J. W. SALIARD,
W. S. CURTIS,
Judges.

CLASS 31—LEICESTERS.

Best ram, 2 years old or over, Mrs. Ann Newton, Pontiac	$15 00
2d do., A. F. Wood, Mason	10 00
3d do., A. F. Wood, Mason	6 00
Best ram lamb, 1 year old, Mrs. Ann Newton, Pontiac	12 00
2d do., A. F. Wood. Mason	8 00
3d do., Wm. S. Bates, Ionia	5 00
Best ram lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., A. F. Wood, Mason	6 00
3d do., A. F. Wood, Mason	4 00
Best ewe, 2 years old or over, Mrs. Ann Newton, Pontiac	15 00
2d do., A. F. Wood, Mason	10 00
3d do., Wm. S. Bates, Ionia	6 00
Best ewe, 1 year old, Mrs. Ann Newton, Pontiac	12 00
2d do., A. F. Wood, Mason	8 00
3d do., A. F. Wood, Mason	5 00
Best ewe lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., Wm. S. Bates, Ionia	6 00
3d do., A. F. Wood, Mason	4 00

G. HOWARD,
J. W. SALIARD,
W. S. CURTIS,
Judges.

CLASS 32—FAT SHEEP.

Best middle wooled wether, 2 years old, Mrs. Ann Newton, Pontiac	$10 00
Best middle wooled wether, 1 year old, Mrs. Ann Newton, Pontiac	10 00
2d do., James Conley, Marshall	8 00
3d do., Frank Willson, Jackson	5 00
Best long wooled wether, 2 years old, Frank Willson, Jackson	10 00
2d do., Mrs. Ann Newton, Pontiac	8 00
Best long wooled wether, 1 year old, Frank Willson, Jackson	10 00
Best graded wether, 2 years old. J. F. Rundel, Birmingham	10 00
2d do., John Moriarty, Hudson	5 00
Best grade wether, 1 year old, A. L. Richardson, Jackson	10 00
2d do., J. F. Rundel, Birmingham	8 00
3d do., Mrs. Ann Newton, Pontiac	5 00

G. HOWARD,
J. W. SALIARD,
W. S. CURTIS,
Judges.

DIVISION D—SWINE.

CLASS 33—BERKSHIRES.

Best boar, 2 years old or over, B. N. Cooley, Coldwater	$12 00
Best boar, 1 year old, A. W. Cooley, Coldwater	10 00
2d do., G. D. White, South Butler	6 00
Best boar, under 1 year old, A. W. Cooley, Coldwater	8 00
2d do., G. D. White, South Butler	3 00
Best brood sow, 2 years old or over, G. D. White, South Butler	12 00
Best sow, 1 year old, A. W. Cooley, Coldwater	10 00
2d do., B. N. Cooley, Coldwater	6 00
3d do., G. D. White, South Butler	3 00
Best sow, under 1 year old, A. W. Cooley, Coldwater	8 00
2d do., G. D. White, South Butler	5 00
3d do , G. D. White, South Butler	3 00
Best pen of Berkshire pigs, G. D. White, South Butler	8 00
2d do., B. N. Cooley, Coldwater	5 00
Best Berkshire boar, any age, B. N. Cooley, Coldwater	Diploma

F. W. GRINNELL, *Judge.*

ESSEX.

Best boar, 2 years old or over, M. H. Walworth, Hillsdale	$12 00
2d do., Frank Willson, Jackson	8 00
3d do., E. T. Doney, Jackson	4 00

Best boar, 1 year old, A. Chandler, Jerome	$10 00
2d do., Frank Willson, Jackson	6 00
3d do., A. F. Wood, Mason	3 00
Best boar, under 1 year old, W. A. Higgans, Jackson	8 00
2d do., Frank Willson, Jackson	5 00
3d do., Frank Willson, Jackson	3 00
Best brood sow, 2 years old or over, Frank Willson, Jackson	12 00
2d do., E. T. Doney, Jackson	8 00
3d do., A. Chandler, Jerome	4 00
Best sow, 1 year old, Frank Willson, Jackson	10 00
2d do., Frank Willson, Jackson	6 00
3d do., C. M. Fellows, Manchester	3 00
Best sow, under 1 year, Frank Willson, Jackson	8 00
2d do., E. T. Doney, Jackson	5 00
3d do., A. Chandler, Jerome	3 00
Best pen of Essex pigs, Frank Willson, Jackson	8 00
2d do., A. Chandler, Jerome	5 00
3d do., W. A. Higgins, Jackson	3 00
Best Essex boar, any age, A. Chandler, Jerome	Diploma

F. W. GRINNELL, *Judge.*

SUFFOLK, SMALL YORKSHIRE OR VICTORIA.

Best boar, 2 years old or over, Frank Willson. Jackson	$12 00
2d do., M. H. Walworth, Hillsdale	8 00
Best boar, 1 year old, Frank Willson, Jackson	10 00
2d do., H. W. Riley & Co., Greenville	6 00
3d do., W. M. Hilbert, North Lansing	3 00
Best boar, under 1 year, M. H. Walworth, Hillsdale	8 00
2d do., Frank Willson, Jackson	5 00
3d do., Frank Willson, Jackson	5 00
Best brood sow 2 years old or over, W. M. Hilbert, North Lansing	12 00
2d do., Frank Willson, Jackson	8 00
3d do., M. H. Walworth, Hillsdale	4 00
Best sow 1 year old, M. H. Walworth. Hillsdale	10 00
2d do., M. H. Walworth, Hillsdale	6 00
3d do., Frank Willson, Jackson	3 00
Best sow under 1 year old. Frank Willson, Jackson	8 00
2d do., M. H. Walworth, Hillsdale	5 00
3d do. H. W. Riley & Co., Greenville	3 00
Best pen of Suffolk, Small Yorkshire or Victoria pigs, Frank Willson, Jackson	8 00
2d do., Frank Willson, Jackson	5 00
3d do., W. M. Hilbert, North Lansing	3 00
Best Suffolk, Small Yorkshire or Victoria boar, any age, Frank Willson, Jackson	Diploma

F. W. GRINNELL, *Judge.*

POLAND-CHINA.

Best boar, 2 years old or over, L. W. & O. Barnes, Byron	$12 00
2d do., W. H. Ashley, Homer	8 00
3d do., H. M. Morse, Union City	4 00
Best boar, 1 year old, L. W. & O. Barnes, Byron	10 00
2d do., H. W. Riley & Co., Greenville	6 00
3d do., C. A. Limbeck, Dowagiac	3 00
Best boar under 1 year old, C. A. Limbeck	8 00
2d do., H. M. Morse, Union City	5 00
3d do., C. A. Limbeck	3 00
Best brood sow, 2 years old or over, L. W. & O. Barnes	12 00
2d do., G. F. Harrington, Paw Paw	8 00
3d do., H. W. Riley & Co.	4 00
Best sow 1 year old, L. W. & O. Barnes	10 00
2d do., G. F. Harrington	6 00
3d do., H. W. Riley & Co.	3 00

Best sow under 1 year old, G. F. Harrington	$8 00
2d do., C. A. Limbeck	5 00
3d do., A. L. Richardson, Jackson	3 00
Best pen Poland-China pigs, C. A. Limbeck	8 00
2d do., G. F. Harrington	5 00
3d do., G. F. Harrington	3 00
Best Poland-China boar, any age, L. W. & O. Barnes, Byron	Diploma

F. W. GRINNELL, *Judge.*

DUROC JERSEY.

Second best boar, two years old or over, C. H. Williams, Coldwater	$8 00
Best boar, one year old, Quincy McBride, Burton	10 00
2d do., Bissell & Badgley, Jackson	6 00
3d do., C. H. Williams, Coldwater	3 00
Best boar under 1 year old, Quincy McBride, Burton	8 00
2d do., C. H. Williams, Coldwater	5 00
3d do., C. H. Williams, Coldwater	3 00
Best brood sow, 2 years old or over, Quincy McBride, Burton	12 00
2d do., C. H. Williams, Coldwater	8 00
3d do., C. H. Williams, Coldwater	4 00
Best sow 1 year old, Quincy McBride, Burton	10 00
2d do., C. H. Williams, Coldwater	6 00
Best sow, under 1 year old, Bissell & Badgley, Jackson	8 00
2d do., Quincy McBride, Burton	5 00
3d do., Quincy McBride, Burton	3 00
Best pen of Duroc-Jersey pigs, Quincy McBride, Burton	8 00
2d do., C. H. Williams, Coldwater	5 00
Best Duroc-Jersey boar, any age, Quincy McBride, Burton	Diploma

F. W. GRINNELL, *Judge.*

CHESTER WHITE AND OTHER LARGE BREEDS NOT ENUMERATED.

Best boar, 1 year old, C. A Searing, Lyons	$10 00
2d do., C. F. Palmer, London	6 00
Best boar, under 1 year old, A. L. Richardson, Jackson	8 00
2d do., A. L. Richardson, Jackson	5 00
3d do.. C. A. Searing, Lyons	3 00
Best brood sow, 2 years old or over, C. A. Searing, Lyons	12 00
Best sow, 1 year old, C. A. Searing, Lyons	10 00
2d do., C. F. Palmer, London	6 00
Best sow, under 1 year old, A. L. Richardson, Jackson	8 00
2d do., C. A. Searing, Lyons	5 00
3d do., C. A. Searing, Lyons	3 00
Best pen of Chester White or other large breed of pigs, C. A. Searing, Lyons	8 00
2d do., A. L. Richardson, Jackson	5 00
3d do., C. A. Searing. Lyons	3 00
Best Chester White or other large breed boar, A. L. Richardson, Jackson	Diploma

F. W. GRINNELL, *Judge.*

FAT HOGS.

Best barrow, over 1 year old, Frank Willson, Jackson	$10 00
2d do., E. T. Doney, Jackson	6 00
3d do., Frank Willson, Jackson	3 00
Best barrow, less than ten months old, E. T. Doney, Jackson	6 00
2d do Frank Willson, Jackson	4 00
3d do., A. L. Richardson, Jackson	2 00

F. W. GRINNELL, *Judge.*

DIVISION E—POULTRY.

CLASS 34.

Best pair Light Brahma fowls, J. F. Cunliffe, Jackson	$1 50
2d do., C. L. Hogue, Battle Creek	1 00

Best pair Light Brahma chicks, Jas. Ball, Marshall	$1 50
2d do., J. F. Cunliffe, Jackson	1 00
Best pair Dark Brahma fowls, Jas. Ball, Marshall	1 50
Best pair Buff Cochin fowls, Jas. Ball, Marshall	1 50
2d do., J. A. Tucker, Concord	1 00
Best pair Buff Cochin chicks, J. A. Tucker, Concord	1 50
2d do., M. H. Walworth, Hillsdale	1 00
Best pair Partridge Cochin fowls, Jas. Ball, Marshall	1 50
Best pair chicks, Jas. Ball, Marshall	1 50
Best pair White Cochin fowls, Jas Ball, Marshall	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair White Cochin chicks, Jas. Ball, Marshall	1 50
2d do., J. A. Tucker, Concord	1 00
Best pair Black Cochin chicks, Jas. Ball, Marshall	1 50
Best pair Langshan fowls, Jas. Ball, Marshall	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Best pair Langshan chicks, C. L. Hogue, Battle Creek	1 50
2d do., Jas. Ball, Marshall	1 00
Best pair Plymouth Rock fowls, C. L. Hogue, Battle Creek	1 50
2d do., J. F. Cunliffe, Jackson	1 00
Best pair Plymouth Rock chicks, J. F. Cunliffe, Jackson	1 50
2d do., J. F. Cunliffe, Jackson	1 00
Best pair Wyandotte fowls, C. L. Hogue, Battle Creek	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Best pair Wyandotte chicks, C. L. Hogue, Battle Creek	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Best pair Dominique chicks, M. H. Walworth, Hillsdale	1 50
Best pair Dominique fowls, M. H. Walworth, Hillsdale	1 50
Best pair black-breasted red game bantam fowls, Z. A. Hartsuff, Unadilla	1 00
Best pair black-breasted red game bantam chicks, C. L. Hogue, Battle Creek	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair yellow duck-wing bantam fowls, Z. A. Hartsuff, Unadilla	1 50
Best pair silver duck-wing bantam fowls, Z. A. Hartsuff, Unadilla	1 50
Best pair silver duck-wing chicks, Z. A. Hartsuff, Unadilla	1 50
Best pair red pile bantam fowls, F. E. Belamy, Jonesville	1 50
Best pair red pile bantam chicks, F. E. Belamy, Jonesville	1 50
Best pair white pile bantam chicks, Z. A. Hartsuff, Unadilla	1 50
Best pair golden Seabright bantam fowls, Z. A. Hartsuff, Unadilla	1 50
Best pair golden Seabright bantam chicks, Z. A. Hartsuff, Unadilla	1 50
2d best silver Seabright bantam fowls, Z. A. Hartsuff, Unadilla	1 00
Best pair black bantam fowls, Jas. Ball, Marshall	1 50
2d do., A. G. Weston, Unadilla	1 00
Best pair colored Dorking fowls, M. H. Walworth, Hillsdale	1 50
Best pair colored Dorking chicks, M. H. Walworth, Hillsdale	1 50
Best pair Houdan fowls, A. G. Weston, Unadilla	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair Houdan chicks, A. G. Weston, Unadilla	1 50
Best pair black-breasted red game fowls, Dyer Bros., Jackson	1 50
2d do., Dyer Bros., Jackson	1 00
Best pair black-breasted red game chicks, Dyer Bros., Jackson	1 50
2d do., Dyer Bros., Jackson	1 00
Best pair brown-breasted red game fowls, Dyer Bros., Jackson	1 50
Best pair brown-breasted red game chicks, Dyer Bros., Jackson	1 50
2d do., Dyer Bros., Jackson	1 00
Best pair yellow duck-wing game fowls, Dyer Bros., Jackson	1 50
Best pair red Pile game fowls, Dyer Bros., Jackson	1 50
Best pair white Pile game fowls, Dyer Bros., Jackson	1 50
Best pair white Pile game chicks, Dyer Bros., Jackson	1 50
Best pair white game fowls, Dyer Bros., Jackson	1 50
2d do., Dyer Bros., Jackson	1 00
Best pair white game chicks, Dyer Bros., Jackson	1 50
Best pair golden-spangled Hamburg fowls, M. H. Walworth, Hillsdale	1 50
Best pair golden-spangled Hamburg chicks, M. H. Walworth, Hillsdale	1 50
Best pair silver-spangled Hamburg fowls, M. H. Walworth, Hillsdale	1 50
2d do., A. D. D. Wood, Rives Junction	1 00

Best pair silver-spangled Hamburg chicks, A. D. D. Wood, Rives Junction	$1 50
2d do., J. R. Godfrey, Parma	1 00
Best pair black Hamburg fowls, M. H. Walworth, Hillsdale	1 50
Best pair white-crested black Polish fowls, J. Ball, Marshall	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair white-crested black Polish chicks, J. Ball, Marshall	1 50
2d do., A. E. Vosburgh, Battle Creek	1 00
Best pair golden Polish fowls, A. E. Vosburgh, Battle Creek	1 50
Best pair golden Polish chicks, A. E. Vosburgh, Battle Creek	1 50
2d do., A. E. Vosburgh, Battle Creek	1 00
Second best golden Polish bearded fowls, Z. A. Hartsuff, Unadilla	1 00
Best pair silver Polish bearded fowls, J. Ball, Marshall	1 50
Best pair silver Polish bearded chicks, J. Ball, Marshall	1 50
Best pair black Spanish fowls, Z A. Hartsuff, Unadilla	1 50
Best pair white Leghorn fowls, M. H. Walworth, Hillsdale	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair white Leghorn chicks, M. H. Walworth, Hillsdale	1 50
Best pair brown Leghorn fowls, A. G. Weston, Unadilla	1 50
Best pair brown Leghorn chicks, C. L. Hogue, Battle Creek	1 50
2d do., C. L. Hogue, Battle Creek	1 00
Best pair rose-comb Leghorn fowls, Z. A. Hartsuff, Unadilla	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair black Java fowls, M. H. Walworth, Hillsdale	1 50
2d do., A. G. Weston, Unadilia	1 00
Best pair black Java chicks, M. H. Walworth, Hillsdale	1 50
2d do., A. G. Weston, Unadilla	1 00
Best pair Pekin ducks, Z. A. Hartsuff, Unadilla	1 50
2d do., Sheddon & Co., Jackson	1 00
Best pair Rouen ducks, J. A. Hartsuff, Unadilla	1 50
Best pair white Muscovoy ducks, Z. A. Hartsuff, Unadilla	1 50
Best pair Colona Muscovy ducks, Z. A. Hartsuff, Unadilla	1 50
Best pair Toulouse geese, Z. A. Hartsuff, Unadilla	1 50
Best pair Embden geese, Z. A. Hartsuff, Unadilla	1 50
Best pair white Chinese geese, Z. A. Hartsuff, Unadilla	1 50
Best pair brown Chinese geese, Z. A. Hartsuff, Unadilla	1 50
Best pair bronze turkeys, C. M. Fellows, Manchester	1 50
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair white turkeys, Z. A. Hartsuff, Unadilla	1 50
Best pair pea-fowls, Z. A. Hartsuff, Unadilla	1 50
Best pair pearl Guinea fowls, Z. A. Hartsuff, Unadilla	1 50
Best pair white Guinea fowls, Z. A. Hartsuff, Unadilla	1 50
Best collection of pigeons, F. E. Bellamy, Jonesville	1 50

AMBROSE PURCHASE, *Judge.*

DIVISION F—FARM AND GARDEN PRODUCTS.

CLASS 35—GRAIN AND SEEDS.

Best bushel red wheat, A. L. Richardson, Jackson	$3 00
2d do., J. F. Staebler, Ann Arbor	2 00
Best bushel white wheat, R. E. Gallop, Jackson	3 00
2d do., M. Tanner, Jackson	2 00
Best bushel amber wheat, J. F. Staebler, Ann Arbor	3 00
2d do., Frank Willson, Jackson	2 00
Best bushel white oats, M. Tanner, Jackson	2 00
2d do., A. W. Jewett, Mason	1 00
Best 12 ears yellow Dent corn, C. Lazelle, Napoleon	1 50
2d do., M. Tanner, Jackson	1 00
Best 12 ears white Dent corn, C. Lazelle, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best 12 ears any variety Dent corn, A. G. True, Jackson	1 50
2d do., A. D. Quick, Jackson	1 00
Best 12 ears yellow flint corn, 12-rowed, C. Lazelle, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best 12 ears yellow flint corn, 8-rowed, M. Tanner, Jackson	1 50
2d do., M. Shoemaker, Jackson	1 00

Best 12 ears red flint corn, blazed, M. Shoemaker, Jackson	$1 50
2d do., A. W. Jewett, Mason	1 00
Best 12 ears white flint corn, 8-rowed, M. Tanner, Jackson	1 50
2d do., C. Lazelle, Napoleon	1 00
Best 12 ears white flint corn, blazed, C. Lazelle, Jackson	1 50
Best 12 ears sweet corn, early, A. W. Jewett, Mason	1 50
Best 12 ears popcorn, M. Tanner, Jackson	1 50
2d do., A. W. Jewett, Mason	1 00
Best bushel rye, P. S. Ray, Jackson	2 00
2d do., J. M. Snyder, Jackson	1 00
Best bushel small clover seed, M. Tanner, Jackson	3 00
Best bushel timothy seed, M. Tanner, Jackson	2 00
Best bushel buckwheat, A. W. Jewett, Mason	2 00
2d do., P. S. Ray, Jackson	1 00
Best bushel peas, W. F. Miller, Mason	2 00
2d do., A. W. Jewett, Mason	1 00
Best bushel white beans, M. Tanner, Jackson	2 00
Best display of a general assortment of seeds for field crops, A. W. Jewett, Mason	10 00
Best assortment of kitchen garden seeds, A. W. Jewett, Mason	10 00
Best display of grain in heads, A. W. Jewett, Mason	10 00
Best display of corn in the ear, C. Lazelle, Napoleon	10 00
2d do., A. W. Jewett, Mason	5 00
Best display of the several kinds of grasses in stalk and head, A. W. Jewett, Mason	10 00

R. J. BULLEN, *Judge.*

CLASS 36—ROOTS AND VEGETABLES.

Best peck early Sunrise potatoes, D. B. Harrington, Mason	$1 50
2d do., C. J. Miller, Mason	1 00
Best peck early Vermont potatoes, W. F. Miller, Mason	1 50
2d do., D. B. Harrington, Mason	1 00
Best peck early Ohio potatoes, A. W. Jewett, Mason	1 50
2d do., D. B. Harrington, Mason	1 00
Best peck Early Beauty of Hebron, D. B. Harrington, Mason	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck Ontario potatoes, D. B. Harrington, Mason	1 50
2d do., W. F. Miller, Mason	1 00
Best peck late Rose potatoes, C. J. Miller, Mason	1 50
2d do., W. F. Miller, Mason	1 00
Best peck White Elephant potatoes, C. J. Miller, Mason	1 50
2d do., D. B. Harrington, Mason	1 00
Best peck Granger potatoes, D. B. Harrington, Mason	1 50
Best peck Burbank potatoes, D. B. Harrington, Mason	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck Mammoth Pearl potatoes, C. J. Miller, Mason	1 50
2d do., W. F. Miller, Mason	1 00
Best peck White Star potatoes, D. B. Harrington, Mason	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck Belle potatoes, C. J. Miller, Mason	1 50
2d do., W. F. Miller, Mason	1 00
Best peck of late Beauty of Hebron potatoes, W. F. Miller, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best peck Snow Flake potatoes, A. W. Jewett, Mason	1 50
2d do., D. B. Harrington, Mason	1 00
Best peck sweet potatoes, A. W. Jewett, Mason	1 50
Best 6 blood beets, C. Lazelle, Napoleon	1 50
2d do., C. J. Miller, Mason	1 00
Best 6 turnip beets, H. Wixom, Mason	1 50
2d do., W. F. Miller, Mason	1 00
Best 6 sugar beets, H. Wixom, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best 6 white or yellow beets, H. Wixom, Mason	1 50
Best 6 beets for table use, W. F. Miller, Mason	1 50
2d do., C. J. Miller, Mason	1 00

Best 6 mangel wurtzel, C. J. Miller, Mason	$1 50
2d do., Frank Willson, Jackson	1 00
Best 6 orange carrots, C. J. Miller, Mason	1 50
2d do., H. Wixom, Mason	1 00
Best 6 white carrots, Frank Willson, Jackson	1 50
2d do., C. J. Miller, Mason	1 00
Best 6 any kind of carrots, C. J. Miller, Mason	1 50
2d do., A. D. Quick, Jackson	1 00
Best 6 flat turnips, W. F. Miller, Mason	1 50
Best 6 sweet turnips, Chas. Misler, Jackson	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 any variety turnips, A. D. Quick, Jackson	1 50
2d do., W. F. Miller, Mason	1 00
Best 6 parsnips, H. Wixom, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best 6 salsify, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best 6 winter radishes, C. Lazelle, Napoleon	1 50
Best 6 summer radishes, H. Purdy, Jackson	1 50
2d do., H. Purdy, Jackson	1 00
Best 4 heads drumhead cabbage, H. Wixom, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best 4 head cone-head cabbage, H. Wixom, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best 4 head red cabbage, C. J. Miller, Mason	1 50
2d do., W. F. Miller, Mason	1 00
Best 4 head lettuce, C. Misler, Jackson	1 50
2 do., H. Purdy, Jackson	1 00
Best 6 bunches kale, A. W. Jewett, Mason	1 50
Best dozen stems celery, S. Heyser, Jackson	1 50
2d do., M. Harmon, Jackson	1 00
Best dozen stems rhubard, C. Miller, Mason	1 50
2d do., H. Purdy, Jackson	1 00
Best vegetable egg, C. Lazelle, Napoleon	1 50
Best dozen peppers, A. W. Jewett, Mason	1 50
2d do., P. C. Buckley, Leoni	1 00
Best 3 variety tomatoes, P. C. Buckley, Leoni	1 50
Best peck any variety tomatoes, C. Lazelle, Napoleon	1 50
Best peck white onions, C. Lazelle, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck red onions, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best peck yellow onions, M. Harmon, Jackson	1 50
2d do., S. Heyser, Jackson	1 00
Best summer squash, A. W. Jewett, Mason	1 50
2d do., C. Lazelle, Napoleon	1 00
Best 5 marrow squashes, C. J. Miller, Mason	1 50
2d do., A. W. Jewett, Mason	1 00
Best 5 Hubbard squashes, C. J. Miller, Mason	1 50
Best field pumpkins, A. G. True, Jackson	1 50
2d do., C. Lazelle, Napoleon	1 00
Best 3 watermelons, A. D. Quick, Jackson	1 50
2d do., C. Lazelle, Napoleon	1 00
Best 3 citrons, C. Lazelle, Napoleon	1 50
2d do., P. S. Ray, Norvell	1 00
Best 5 cucumbers, C. J. Miller, Mason	1 50
2d do., C. Lazelle, Napoleon	1 00
Best half peck garden peas, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best half peck Lima beans, A. W. Jewett, Mason	1 50
Best half peck bush beans, Mrs. D. H. Ranney, Jackson	1 50
2d do., A. W. Jewett, Mason	1 00
Best half peck wax beans, H. Purdy, Jackson	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 heads sunflower, Mrs. H. D. Ranney, Jackson	1 50
2d do., A. D. Quick, Jackson	1 00

Best 6 stems Swiss chard, A. W. Jewett, Mason	$1 50
Best 6 stems parsley, C. J. Miller, Mason	1 50
2d do., A. W. Jewett, Mason	1 00
Best 6 stems spinach, C. Misler, Jackson	1 50
2d do., H. Purdy, Jackson	1 00
Best 6 stems kohl rabi, A. W. Jewett, Mason	1 50
2d do., C. J. Miller, Mason	1 00
Best 2 sweet pumpkins, C. Lazelle, Napoleon	1 50
2d do., A. W. Jewett, Mason	1 00
Best peck English multiplier onions, H. Purdy, Jackson	1 00
Best peck Monroe seedling potatoes, J. F. Staebler, Ann Arbor	1 00

G. A. GILLESPIE, *Judge.*

CLASS 37—DISPLAY OF ROOTS AND VEGETABLES BY PROFESSIONAL GARDENERS.

Best display roots and vegetables, Z. J. & H. B. Davis, Jackson	$40 00
Best display of potatoes, D B. Harrington, Mason	25 00
2d do., A. W. Jewett, Mason	15 00

G. A. GILLESPIE,
HARVEY WILSON,
Judges.

CLASS 38—FLOUR, MEAL AND FEED.

Best barrel flour made of white wheat, Eldred Milling Co., Jackson	$3 00
Best barrel flour made of red wheat, Eldred Milling Co., Jackson	3 00
Best and largest display of flour, meal and feed, Eldred Milling Co., Jackson	5 00

D. B. HARRINGTON, *Judge.*

DIVISION G—DAIRY AND OTHER PRODUCTS.

CLASS 39—BUTTER, CHEESE AND DAIRY ARTICLES.

Best 25 pounds domestic butter, Mrs. Marshall, Parma	$10 00
2d do., Ogden Cole, Addison	8 00
3d do., F. D. Kinney, Onsted	5 00
Best 25 pounds creamery butter, Ashley & Stephens, Three Oaks	10 00
2d do., Baker & Paddoc, Concord	8 00
3d do., Mrs. W. A. Reynolds, Blissfield	5 00
Best 5 pounds print butter, F. M. Ellison, Jackson	4 00
2d do., Mrs. Marshall, Parma	3 00
3d do., Mrs. H. D. Ranney, Jackson	2 00

WALTER BORDWELL,
C. P. BAKER,
MRS. C. P. BAKER,
Judges.

CLASS 40—SUGAR, BREAD AND PICKLES.

Best syrup made from amber cane or sorghum, Mrs. A. Quithel, Rives Junction	$10 00
2d do., Byron Crary, Brooklyn	5 00
Best machine made bread, J. A. Shelly, Jackson	3 00
Best 3 loaves bakers' bread, Peterman & Co., Jackson	3 00
Best 3 loaves milk or salt-rising bread, Alice Holcomb, Jackson	3 00
2d do., Mrs. M. E. Bartlett, Jackson	2 00
Best 3 loaves soda-rising bread, Mrs. A. E. Wells, Jackson	3 00
2d do., Mrs. M. E. Bartlett, Jackson	2 00
Best 3 loaves yeast-rising bread, Mrs. M. E. Bartlett, Jackson	3 00
2d do., Mrs. O. S. Fish, Parma	1 00
Best corn bread, Mrs. M. E. Bartlett, Jackson	3 00
2d do., Mrs. W. A. Reynolds, Blissfield	2 00
Best 3 loaves brown bread, Mrs. J. M. Simpson, Jackson	3 00
2d do., Mrs. D. H. Ranney, Jackson	2 00

Best sample flour bread, made by girl 16 or under, Mrs. M. E. Bartlett, Jackson	$3 00
2d do., Miss Carrie Case, Jackson	2 00
Best sample brown bread, made by girl under 16 years, Miss Della Snyder, Henrietta	3 00
2d do., Mrs. M. E. Bartlett, Jackson	2 00
Best display of pickled vegetables, Mrs. D. H. Ranney, Jackson	5 00
2d do., Mrs. M. E. Bartlett, Jackson	3 00
Pork pies, Mrs. Marshall, Parma	50
Dry buns, Mrs. Mary Rogers, Jackson	50
Dry spice rusks, Mrs. Mary Rogers, Jackson	50
Sample gingerbread, Mrs. S. J. Madden, Jackson	50
Sample doughnuts, Mrs. S. J. Madden, Jackson	50
Plum pudding, Mrs. Marshall, Parma	50
Canned peaches, Mrs. J. M. Simpson, Jackson	1 00

WALTER BORDWELL,
C. P. BAKER,
MRS. C. P. BAKER,
Judges.

DIVISION H—HONEY, BEES, ETC.

CLASS 42—BEES, HONEY AND APIARIAN IMPLEMENTS.

Best colony black bees, H. D. Cutting, Clinton	$10 00
2d do., A. F. Unterkircher, Manchester	5 00
Best colony Italian bees, A. F. Unterkircher, Manchester	10 00
2d do., A. D. D. Wood, Rives Junction	5 00
Best colony Syrian bees, H. D. Cutting, Clinton	10 00
2d do., A. D. D. Wood, Rives Junction	5 00
Best colony Cornialan bees, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Rogersville	5 00
Best display of full colonies of different races of bees, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Rogersville	5 00
Best specimen comb honey, 25 pounds, A. F. Unterkircher, Manchester	10 00
2d do., W. Z. Hutchinson, Rogersville	5 00
Best display comb honey, W. Z. Hutchinson, Rogersville	20 00
2d do., A. M. Gander, Adrian	10 00
Best specimen extracted honey, 25 pounds, W. Z. Hutchinson, Rogersville	8 00
2d do., A. M. Gander, Adrian	4 00
Best display extracted honey, H. D. Cutting, Clinton	12 00
2d do., A. M. Gander, Adrian	6 00
Best display comb honey by a lady, Miss Anna R. Cutting, Clinton	10 00
2d do., Miss May Hutchinson, Rogersville	5 00
Best 10 pounds beeswax, A. D. D. Wood, Rives Junction	5 00
2d do., H. D. Cutting, Clinton	3 00
Best bee feeder, W. Z. Hutchinson, Rogersville	2 00
2d do., Miss Anna R. Cutting, Clinton	1 00
Best bee smoker, A. F. Unterkircher, Manchester	2 00
2d do., H. D. Cutting, Clinton	1 00
Best bee hive, H. D. Cutting, Clinton	5 00
2d do., W. D. Soper, Jackson	3 00
Best comb foundation machine, A. D. D. Wood, Rives Junction	8 00
2d do., H. D. Cutting, Clinton	4 00
Best comb foundation made on the grounds, H. D. Cutting, Clinton	5 00
2d do., A. D. D. Wood, Rives Junction	3 00
Best specimen comb foundation, A. D. D. Wood, Rives Junction	4 00
2d do., W. D. Soper, Jackson	2 00
Best honey extractor, A. M. Gander, Adrian	5 00
2d do., A. D. D. Wood, Rives Junction	3 00
Best queen cage for introducing queens, A. O. Quick, Leoni	2 00
2d do., W. D. Soper, Jackson	1 00
Best queen cage for shipping, W. Z. Hutchinson, Rogersville	2 00
2d do., H. D. Cutting, Clinton	1 00
Best section box for comb honey, W. D. Soper, Jackson	2 00
2d do., A. F. Unterkircher, Manchester	1 00

Best wax extractor, A, F. Unterkircher, Manchester	$3 00
2d do., W. Z. Hutchinson, Rogersville	2 00
Best collection honey producing plants, Miss Anna R. Cutting, Clinton	10 00
2d do., H. D. Cutting, Clinton	5 00
Largest, best and most instructive exhibition in this class, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Rogersville	6 00

A. J. COOK, *Judge.*

DIVISION L—MANUFACTURED GOODS.

CLASS 53—FACTORY MADE.

Best perfumery, Foot & Jenks, Jackson	Diploma

CLASS 54—ARTICLES OF DRESS.

Best display of robes and furs, P. H. Linton, Jackson	Diploma

CLASS 55—ARTICLES OF LEATHER AND INDIA RUBBER.

Best display of trunks, Merriman & Co., Jackson	$10 00
Best double carriage harness, Merriman & Co., Jackson	3 00
Best single buggy harness, Merriman & Co., Jackson	3 00
Best double harness for farm, Merriman & Co., Jackson	3 00
Best sole leather, Cowley & Davis, Jackson	5 00
Best gentleman's riding saddle, Merriman & Co., Jackson	2 00
Best lady's riding saddle, Merriman & Co., Jackson	3 00
Best riding bridle, Merriman & Co., Jackson	2 00
Best display of boots and shoes, Cowley & Davis, Jackson	10 00
Best ladies' hand trunk, Merriman & Co., Jackson	Diploma

EUGENE FIFIELD,
J. M. STERLING,
Judges.

CLASS 56—ARTICLES OF FURNITURE.

Best display of furniture, H. C. Ransom, Jackson	$25 00
2d do., Henry Simmons, Jackson	15 00
Best set of parlor furniture, Henry Simmons, Jackson	20 00
2d do., H. C. Ransom, Jackson	10 00
Best set of chamber furniture, H. C. Ransom, Jackson	10 00
2d do., Henry Simmons, Jackson	7 00
Best set of dining room furniture, H. C. Ransom, Jackson	3 00
2d do., Henry Simmons, Jackson	2 00
Best book case, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best center table, H. C. Ransom, Jackson	3 00
2d do., Henry Simmons, Jackson	2 00
Best child's crib, H. C. Ransom, Jackson	2 00
Best child's carriage, H. C. Ransom, Jackson	2 00
Best dressing bureau, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best desk, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best easy chair, H. C. Ransom, Jackson	3 00
2d do., Henry Simmons, Jackson	2 00
Best extension table, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best hall 3 hat rack, H. C. Ransom, Jackson	2 00
2d do., Henry Simmons, Jackson	1 00
Best lounge and couch, Henry Simmons, Jackson	3 00
2d do., Henry Ransom, Jackson	2 00
Best library table, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best mantel mirror, H. C. Ransom, Jackson	5 00
Best mattrass for bed, H. C. Ransom, Jackson	2 00
2d do., Henry Simmons, Jackson	1 00

Best office desk, H. C. Ransom, Jackson	$3 00
2d do., Henry Simmons, Jackson	2 00
Best office chair, H. C. Ransom, Jackson	2 00
Best parlor writing desk, H. C. Ransom, Jackson	3 00
Best sofa, H. C. Ransom, Jackson	3 00
2d do., Henry Simmons, Jackson	2 00
Best smoking or lounging chair, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best sideboard, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best secretary, H. C. Ransom, Jackson	3 00
2d do., Henry Simmons, Jackson	2 00
Best spring mattress, H. C. Ransom, Jackson	2 00
Best upholstered reception chair, H. C. Ransom, Jackson	3 00
2d do., Henry Simmons, Jackson	2 00
Best display of willow or rattan chairs, H. C. Ransom, Jackson	2 00
Folding bed, Henry Simmons, Jackson	3 00

EUGENE FIFIELD,
J. M. STERLING,
Judges.

DIVISION M—MUSICAL INSTRUMENTS, SEWING MACHINES, CLOCKS, ETC.

CLASS 60—CLOCKS, JEWELRY, PLATEDWARE, ETC.

Fancy clock, C. E. Aldrich, Jackson	$2 00

M. P. ANDERSON, *Judge.*

DIVISION N—ART.

CLASS 61—PAINTING, SCULPTURE, ETC., BY PROFESSIONALS OR AMATEURS.

Best collection of oil paintings, Brow & Baxter, Detroit	$200 00
Best collection of water colors, Brow & Baxter, Detroit	25 00
Best historical painting in oil, Brow & Baxter, Detroit	20 00
2d do., Brow & Baxter, Detroit	10 00
Best landscape oil painting of Michigan scenery, Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
3d do., Brow & Baxter, Detroit	3 00
Best landscape painting in oil, Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
Best landscape painting water colors, Michigan scenery, Brow & Baxter, Detroit	8 00
2d do., Brow & Baxter, Detroit	5 00
3d do., Brow & Baxter, Detroit	2 00
Best marine oil painting, Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
3d do., Brow & Baxter, Detroit	3 00
Best portrait in oil, Brow & Baxter, Detroit	10 00
2d do., W. J. Corden, Jackson	5 00
Best pastel painting of landscape, Brow and Baxter, Detroit	5 00
2d do., Brow & Baxter, Detroit	3 00
3d do., J. H. Wyckoff, Jackson	3 00
Best special subject in oil. Brow & Baxter, Detroit	5 00
2d do., Brow & Baxter, Detroit	3 00
3d do., Mrs. D. C. Meseroll, Jackson	2 00
Best special subject in water colors, Brow & Baxter, Detroit	5 00
2d do., Brow & Baxter, Detroit	3 00
3d do., W. J. Cordon, Jackson	3 00
Best winter piece in oil, Brow & Baxter, Detroit	10 00
2d do., Brow & Baxter, Detroit	5 00
3d do., Mrs. D. C, Meseroll, Jackson	3 00
Best display of gilt frames, Brow & Baxter, Detroit	5 00
Best display of picture frames in bronze or wood, Brow & Baxter, Detroit	5 00
Best collection of photographs, J. H. Wyckoff, Jackson	10 00

Best landscape photograph, J. H. Wyckoff, Jackson	$2 00
Best animal piece from life in oil, W. H. Machen, Detroit	10 00
Best bird piece in oil, W. H. Machen, Detroit	5 00
2d do., W. H. Machen, Detroit	3 00
3d do., Miss H. N. Edgar, Jackson	2 00
4th do., Mrs. D. C. Meseroll, Jackson	1 00
Best composition landscape in oil, J. H. Wyckoff, Jackson	5 00
Best collection of oil paintings, Robert Hopkins, Detroit	10 00
2d do., W. B. Conley, Detroit	5 00
Best collection of water colors, Robert Hopkins, Detroit	5 00
2d do., W. J. Cordon, Jackson	3 00
3d do., Clara Coston, Jackson	3 00
Best fruit piece in oil, W. B. Conley, Detroit	5 00
2d do., W. H. Machen, Detroit	3 00
3d do., Mrs. D. C. Meseroll, Jackson	2 00
Best fancy painting in oil, W. B. Conley, Detroit	5 00
2d do., Clara Coston, Jackson	3 00
Best fancy painting in water colors, Clara Coston, Jackson	5 00
2d do., W. J. Cordon, Jackson	3 00
Best landscape in oil from nature, Robert Hopkins, Detroit	10 00
2d do., Robert Hopkins, Detroit	5 00
Best landscape painting in water colors, Robert Hopkins, Detroit	10 00
2d do., W. J. Cordon, Jackson	5 00
Best marine scene in oil, Robert Hopkins, Detroit	10 00
2d do., Robert Hopkins, Detroit	5 00
Best portrait from life in oil, W. B. Conley, Detroit	10 00
2d do., J. H. Wyckoff, Jackson	5 00
Best portrait painting in pastel, J. H. Wyckoff, Jackson	5 00
2d do., F. W. Spencer, Jackson	3 00
Best pastel painting in water colors, F. W. Spencer, Jackson	5 00
2d do., F. W. Spencer, Jackson	3 00
Best winter piece in oil, W. H. Machen, Detroit	5 00
2d do., Mrs. F. J. Zillicoux, Jackson	3 00
Best crayon portrait, F. H. Hayward, Mt. Clemens	5 00
2d do., Clara Coston, Jackson	3 00
Hand made picture frame—wood, J. V. Brock, Unionville	2 00
Portrait in water colors, F. W. Spencer, Jackson	3 00
Portrait in water colors, F. W. Spencer, Jackson	5 00
Sample scroll work, Maggie Larkin, Jackson	2 00
Etching on linen, Mrs. H. M. Edgar, Jackson	2 00

CHAS. S. HATHAWAY,
F. B. STOCKBRIDGE,
MICHAEL SHOEMAKER,
JOSEPH GREUSEL,
Judges.

CLASS 62—PAINTING AND DRAWING BY AMATEURS.

Best bird piece in oil, Mrs. G. M. Devlin, Jackson	$3 00
Best composition landscape in oil, Delia B. Bidell, Jackson	3 00
Best collection of oil paintings, Mrs. G. M. Devlin, Jackson	3 00
Best collection of water colors, Mrs. G. M. Devlin, Jackson	3 00
Best display of decorated porcelain, Mrs. W. B. Webb, Jackson	10 00
2d do., Mrs. W. B. Webb. Jackson	5 00
Best flower piece in oil, Mrs. Margaret E. Gilbert, Ypsilanti	3 00
2d do., Delia B. Bidell, Jackson	2 00
3d do., Mrs. Chas. Eckliffe, Jackson	1 00
Best landscape painting in water colors, Mrs. G. M. Devlin, Jackson	3 00
Best marine scene in oil, Mrs. G. M. Devlin, Jackson	3 00
2d do, Mrs. S. A. Cooley, Jackson	2 00
Best painting on porcelain, Mrs. D. C. Meseroll, Jackson	3 00
2d do., Mrs. W. B. Webb, Jackson	2 00
Best specimen painting on plaque, Mrs. W. B. Webb, Jackson	3 00
2d do., Grace W. Ford, Jackson	2 00
3d do., Delia B. Bidell, Jackson	1 00
Best specimen painting on silk, Mrs. S. A. Cooley, Jackson	3 00

Best crayon drawing of face, F. H. Hayward, Mt. Clemens	$3 00
2d do., Grace W. Ford. Jackson	2 00
3d do., Nellie Cotter, Jackson	1 00
Best crayon drawing of animal, Grace W. Ford, Jackson	3 00
2d do., Carebell Crane, Jackson	2 00
Best crayon drawing of landscape, Nettie E. Webb, Jackson	2 00
2d do., Grace W. Ford, Jackson	1 00
Best pencil drawing by a person under 16 years of age, Nellie Cotter, Jackson	2 00
2d do., Wm. A. Bowman, Jackson	1 00
3d do., Nellie Cotter, Jackson	1 00
Best specimen machinery drawing, H. Saunders, Jackson	3 00
Charcoal drawing of face, F. H. Hayward, Mt. Clemens	3 00
Collection of painting on plush, etc., Mrs. W. A. Reynolds, Blissfield	3 00
Spatter work in India ink, Mrs. M. A. Chisholm, Marshall	1 00
Album of sea mosses, Mrs. M. A. Chisholm, Marshall	3 00
Pen etching on cotton, Mrs. F. Bradley, Jackson	1 00
Lustre painting on velvet, Mrs. J. P. Crandall, Jackson	2 00

CHAS. S. HATHAWAY,
F. B. STOCKBRIDGE,
M. SHOEMAKER,
JOSEPH GREUSEL,
Judges.

DIVISION O—NEEDLE AND FANCY WORK.

CLASS 63—ARTICLES OF LADIES' DRESS.

Best child's suit, Mrs. J. E. Van Deusen, Jackson	$2 00
Best corset, Bortree Manufacturing Co., Jackson	2 00
2d do., Detroit Excelsior Corset Co., Detroit	1 00
Best display of millinery goods, J. C. Richardson, Jackson	5 00
Best infant's suit, A. D. Quick, Jackson	1 00
Best suit of undergarments, Mrs. Chas. Sterrett, Dowagiac	2 00
2d do., Mrs. A. C. Sterns, Kalamazoo	1 00
Best display of corsets, Detroit Excelsior Corset Co., Detroit	3 00

J. A. WEBB,
D. S. WILLIAMS,
Judges.

CLASS 64—PLAIN NEEDLE AND MACHINE WORK.

Best braiding by hand, Mrs. E. S. Brownson, Jackson	$1 00
2d do., Mrs. Joel Carpenter, Blissfield	50
Best darning, Maggie Trust, Jackson	1 00
2d do., Mrs. M. A. Chisholm, Marshall	50
Best fine shirt, Mrs. W. A. Reynolds, Blissfield	2 00
2d do., Mrs. Joel Carpenter, Blissfield	1 00
Best specimen hemstitching, Mrs. M. E. Bartlett, Jackson	2 00
2d do., Mrs. Fred Bradley, Jackson	1 00
Best sample patched garment, Mrs. M. A. Chisholm, Marshall	1 00
2d do., Mrs. W. A. Reynolds, Blissfield	50
Best pair plain handkerchiefs by hand, Mrs. E. Bartlett, Jackson	1 00
2d do., Mrs. A. C. Stearns, Kalamazoo	50
Best pair plain pillow cases by hand, Uri Isbel, Stockbridge	1 00
2d do., Mrs. M. E. Bartlett, Jackson	50
Best plain sheets by hand, Mrs. M. A. Chisholm, Marshall	1 00
2d do., Mrs. A. C. Stearns, Kalamazoo	50
Best plain white muslin quilt by hand, Mrs. W. F. Mills, Kalamazoo	2 00
Best calico patchwork quilt by hand, Mrs. Halsted, Horton	2 00
2d do., Mrs. Joel Carpenter, Blissfield	1 00
Best silk patchwork quilt by hand, Mrs. M. A. Goff, Jonesville	5 00
2d do., Fannie Byrnes, Dowagiac	3 00
Best worsted patchwork quilt by hand, Mrs. Joel Carpenter, Blissfield	2 00
2d do., Mrs. M. A. Chisolm, Marshall	1 00
Best quilt made and quilted by machine, Mrs. Joel Carpenter, Blissfield	2 00
2d do., Mrs. S. J. Madden, Jackson	1 00

Carpet coverlet, Alice Holcomb, Jackson	$2 00
Silk patchwork pillow, Mrs. Fred Bradley, Jackson	1 00

J. A. WEBB,
D. S. WILLIAMS,
Judges.

CLASS 65—EMBROIDERY AND ORNAMENTAL NEEDLE WORK.

Best arasene embroidery, Fannie Byrnes, Dowagiac	$2 00
2d do., Mrs. M. S. Gilbert, Jackson	1 00
Best chenille embroidery, Mrs. C. Hermenan, Detroit	2 00
2d do., Fannie Byrnes, Dowagiac	1 00
Second best crewel embroidery, Mrs. E. S. Brownson, Jackson	1 00
Best Kensington embroidery, Mrs. D. Merriman, Jackson	2 00
2d do., Mrs. E. A. Howland, Brooklyn	1 00
Best collection of embroidery, Fannie Byrnes, Dowagiac	6 00
Best embroidered banner, Fannie Byrnes, Dowagiac	2 00
2d do., Nellie Cotter, Jackson	1 00
Best embroidered chair or ottoman cover in worsted, Alice Holcomb, Jackson	2 00
2d do., Mrs. C. Sterrett, Dowagiac	1 00
Best embroidered chair or ottoman cover in silk, Nellie Cotter, Jackson	2 00
Best embroidered pillow shams in cotton or linen, Mrs. W. B. Webb, Jackson	2 00
2d do., Mrs. A. C. Stearns, Kalamazoo	1 00
Best embroidered handkerchief in cotton or linen, Mrs. W. B. Webb, Jackson	1 00
2d do., Mrs. E. A. Howland, Brooklyn	50
Best embroidered infant's blanket in silk, Mrs. C. Sterrett, Dowagiac	2 00
2d do., Mrs. Delia Williams, Jackson	1 00
Best embroidered infant's dress in silk, Mrs. J. P. Crandall, Jackson	2 00
2d do., Mrs. C. Sterrett, Dowagiac	1 00
Best embroidered letters in silk, Carrie H. Choate, Jackson	1 00
2d do., Mrs. W. B. Webb, Jackson	50
Best embroidered night dress in cotton or linen, Mrs. A.C.Stearns, Kalamazoo	2 00
Best embroidered piano or table cover, Fannie Byrnes, Dowagiac	4 00
2d do., Nellie Cotter, Jackson	2 00
Best embroidered sofa pillow in silk, Mrs. D. Merriman, Jackson	3 00
2d do., E. K. Chapman, Jackson	1 00
Best embroidered sofa pillow in worsted, Mrs. E. S. Brownson, Jackson	1 00
Best embroidered tidy in silk, Mrs. M. S. Gilbert, Jackson	2 00
2d do., Maggie Trust, Jackson	1 00
Best embroidered toilet set, Mrs. J. P. Crandall, Jackson	2 00
2d do., Margaret Gilbert, Ypsilanti	1 00
Best embroidered table scarf, Miss Nellie Cotter, Jackson	2 00
2d do., Miss Cornelia F. Knapp, Jackson	1 00
Best cut or tufted work, Mrs. W. F. Mills, Kalamazoo	2 00
2d do., Mrs. J. C. Sharp, Jackson	1 00
Best collection of lace work, Mrs. W. F. Mills, Kalamazoo	3 00
2d do., Miss Clara M. Coston, Jackson	2 00
Best Honiton lace, Miss Cornelia F. Knapp, Jackson	2 00
2d do., Mrs. W. F. Mills, Kalamazoo	1 00
Best drawn work, Mrs. D. Merriman, Jackson	2 00
2d do., Mrs. L. Scofield, Wyandotte	1 00
Best darned net work, Mrs. G. H. Begole, Chelsea	1 00
Best darned net pillow shams and bed spread, Mrs. W. B. Webb, Jackson	3 00
Best etching, Mrs. C. Eckliffe, Jackson	2 00
2d do., Mrs. Margaret E. Gilbert, Ypsilanti	1 00
Best fancy pincushion, Mrs. W. B. Webb, Jackson	1 00
2d do., Mrs. J. P. Crandall, Jackson	50
Best fancy bag, Mrs. Margaret E. Gilbert, Ypsilanti	1 00
2d do., Miss Maggie Trust, Jackson	50
Best fancy apron, Miss Cornelia F. Knapp, Jackson	1 00
2d do., Uri Isbell, Stockbridge	50
Best home made rug, crochet or knit, Mrs. W. B. Martin, Jackson	2 00
2d do., Mrs. L. Scofield, Wyandotte	1 00
Best home made rug, drawn, W. H. Sexton, Howell	2 00
2d do., Mrs. M. E. Bartlett, Jackson	1 00
Best pair lamp mats in worsted, Mrs. Delia Williams, Jackson	1 00
2d do., Mrs. E. S. Brownson, Jackson	50

Best pair slippers in silk or worsted, Mrs. Chas. Sterrett, Dowagiac	$1 00
Best specimen macrame work, Miss Delia Snyder, Jackson	2 00
2d do., Mrs. Fred Bradley, Jackson	1 00
Best mantel lambrequin, Mrs. J. E. Tynell, Jackson	2 00
2d do., Mrs. Kate Wodruff, Jackson	1 00
Best specimen rick rack, Mrs. M. E. Bartlett, Jackson	1 00
Best toilet set in lace or muslin, Mrs. M. E. Bartlett, Jackson	1 00
Best tatting, Mrs. W. A. Reynolds, Blissfield	1 00
2d do., Mrs. M. E. Bartlett, Jackson	50
Embroidered handkerchief case, Mrs. J. P. Crandall, Jackson	1 00
Embroidery on linen, Mrs. J. P. Crandall, Jackson	50
Embroidered child's sack, Mrs. Geo. H. Begole, Chelsea	50

N. R. MANN,
M. B. ROBINSON,
Judges.

CLASS 66—CROCHET, KNIT AND FANCY WORK.

Best Afghan robe, Mrs. Joel Carpenter, Blissfield	$5 00
2d do., Miss Margaret E. Gilbert, Ypsilanti	3 00
Best bed spread, crochet or knit, Mrs. James Ritchie, Jackson	3 00
2d do., Mrs. Chas. Eckliffe, Jackson	2 00
Best cotton tidy, Mrs. W. A. Reynolds, Blissfield	2 00
2d do., Mrs. Joel Carpenter, Blissfield	1 00
Best cloak, crochet or knit, Mrs. E. A. Howland, Brooklyn	2 00
2d do., Mrs. George H. Begole, Chelsea	1 00
Best child's afghan robe, Mrs. Chas. Sterrett, Dowagiac	2 00
Best child's shirt, crochet or knit, Miss Carrie H. Choate, Jackson	2 00
2d do., Mrs. W. D. Ford, Jackson	1 00
Best collection of work in this class, Mrs. M. E. Bartlett, Jackson	5 00
2d do., Miss Alice Holcomb	3 00
Best fancy mittens, Miss Carrie H. Choate, Jackson	2 00
2d do., Mrs. M. E. Bartlett, Jackson	1 00
Best hood, Mrs. J. C. Sharp, Jackson	2 00
2d do., Miss Carrie H. Choate, Jackson	1 00
Best infants' shoes, Miss Carrie H. Choate, Jackson	1 00
2d do., Mrs. E. A. Howland, Brooklyn	50
Best leggins, Mrs. Margaret E. Gilbert, Ypsilanti	2 00
Best pair ladies' shoes, crochet or knit, Mrs. M. S. Gilbert, Jackson	2 00
Best pair toilet mats, Mrs. M. E. Bartlett, Jackson	1 00
2d do., Miss Alice Holcomb, Jackson	50
Best skirt, crochet or knit, Mrs. Delia Williams, Jackson	2 00
2d do., Miss Carrie H. Choate, Jackson	1 00
Best shawl, crochet or knit, Mrs. J. C. Sharp, Jackson	3 00
2d do., Mrs. E. A. Howland, Brooklyn	2 00
Best specimen crochet or knit trimming, Mrs. Delia Williams, Jackson	1 00
2d do., Mrs. Halstead, Horton	50
Best worsted tidy, Mrs. M. S. Gilbert, Jackson	1 00
2d do., Z. A. Hartsuff, Unadilla	50
Crochet dress, Miss Estella Dodge, Jackson	1 00
Worsted hassock, Mrs. Delia Williams, Jackson	50

N. R. MANN,
M. B. ROBINSON,
Judges.

CLASS 67—HAIR, SHELL AND WAX WORK.

Best artificial flowers in silk, muslin, paper or feathers, Mrs. Maud Richards, Marshall	$2 00
2d do., Miss Nellie Cotter, Jackson	1 00
3d do., A. S. Fish, Parma	1 00
Best feather duster, J. A. Shelly, Jackson	1 00
Best display of shell work, Mrs. M. E. Bartlett, Jackson	2 00
Best display of wax flowers, Miss Nellie Cotter, Jackson	2 00
2d do., Rev. F. H. Buyse, Jackson	1 00
Best display of wax fruit, Miss Nellie Cotter, Jackson	2 00
Best display of wax work, Miss Nellie Cotter, Jackson	3 00

Best wreath of dried grasses or flowers, Louisa Peckham, Jackson	$2 00
2d do., Mrs. Jennie Barber, Jackson	1 00
Display of cocoons, Miss Mary J. Roberts, Spring Arbor	1 00

J. A. WEBB,
D. S. WILLIAMS,
Judges.

DIVISION P—MISCELLANEOUS.

CLASS 68—MISCELLANEOUS ARTICLES.

Best display of pleasure boats, M. Gilbert, Jackson	Diploma
Ground bone, John A. Shelley, Jackson	$1 00
Best solar salt, J. A. Shelley, Jackson	3 00
Display of stained glass, W. F. Mills, Kalamazoo	Medal

W. B. McCREERY,
SAMUEL JOHNSON.

CLASS 69--HOUSEHOLD ARTICLES.

Best dozen of brooms, Aldrich & Phillips, Jackson	$1 00
Best display of wash tubs, Flemming & Creque, Jackson	1 00
Best clothes dryer, George S. Perry, Battle Creek	1 00
Best carpet stretcher, Z. S. Moore, Jackson	1 00

W. B. McCREERY,
SAMUEL JOHNSON.

DIVISION D—CHILDREN'S DEPARTMENT.

Best specimen hand sewing, Eva S. Stearns, Kalamazoo	$2 00
2d do., Lena Sterrett, Dowagiac	1 00
Best specimen machine sewing, Eva Stearns, Kalamazoo	1 00
Best doll's wardrobe, Mattie Webb, Jackson	2 00
2d do., Eva Stearns, Kalamazoo	1 00
Best painting on tile, Mattie Webb, Jackson	1 00
Best patchwork quilt by hand in silk, Lena Sterrett, Dowagiac	2 00
Best patchwork quilt by hand in calico, Mattie Webb, Jackson	1 00
Best sample canned fruit, Mattie Webb, Jackson	1 00
Best sample canned jelly, Mattie Webb, Jackson	1 00
Best sample of crochet work, Lorena A. Lyon, Jackson	1 00
2d do., Lena Sterrett, Dowagiac	50
Best specimen penmanship, Emily Warner, Jackson	1 00
2d do., Mattie Webb, Jackson	50
Best specimen of patching, Eva S. Stearns, Kalamazoo	1 00
Best display of decorated porcelain, Mattie Webb, Jackson	1 00
Best embroidered canvas, Kathrine Newberry, Jackson	1 00
Best specimen etching, Eva S. Stearns, Kalamazoo	50
Best splasher, Bertha Glidden, Jackson	50
Best afghan robe, Susie Shearer, Jackson	1 00
Best specimen darning, Eva S. Stearns, Kalamazoo	1 00
Best bouquet of dried grasses, Blanch Barber, Jackson	50
Best cage of canaries, Blanch Barber, Jackson	1 00
Best collection of autumn leaves, Blanch Barber, Jackson	1 00
Best specimen paper flowers, Mattie Webb, Jackson	50

CLARA L. TURNER,
MR. JOHN C. SHARP,
Judges.

REPORTS FROM LOCAL SOCIETIES.

ALPENA COUNTY AGRICULTURAL SOCIETY.

SECRETARY'S REPORT.

To the Secretary of the State Board of Agriculture, Lansing, Mich.:

DEAR SIR:—I hereby submit my report of the tenth Annual Fair of the Alpena County Agricultural Society, held at Alpena October 5th, 6th and 7th, 1887:

Total receipts, including county appropriation		$990 00

DISBURSEMENTS.

For premiums as per annexed schedule	$306 75	
All other incidental expenses	448 00	
		754 75
Balance		$235 25

Against which balance there is due for interest on the Society bonds about $435.00.

CLASSIFICATION OF PREMIUMS AWARDED.

Department A—Stock.

Class 1, Horses	$59 50
Class 2, Cattle	53 00
Class 5, Sheep	25 00
Class 6, Hogs	11 00
Class 7, Poultry	8 50

Department B—Grain.

Class 1, Grain	31 50
Class 2, Roots etc	59 00
Class 3, Fruits	7 00

Department C.

Class 1, Flowers	8 25
Class 2, Ornamental and artistic	16 00
Class 3, Domestic and mechanical	5 00

Department D.

Class 1, Dairy and household	$21 00
Class 2, Domestic manufactures	2 00
	$306 75

All of which is respectfully submitted.

F. C. HOLMES,
Secretary.

December 7, 1887.

MANISTEE COUNTY AGRICULTURAL SOCIETY.

This society held its tenth Annual Fair at Bear Lake on the 21st, 22d and 23d days of September, 1886.

Total entries, 1,111, against 692 in 1885.

Receipts, $498.45.

Paid premiums	$305 30
" for hay, repairs and expenses	84 53
" salaries	40 00
" on indebtedness	68 62
	$498 45

OFFICERS FOR YEAR 1887.

President, Henry A. Danville, Marilla.
Secretary, John N. Brodie, Bear Lake.
Treasurer, Leo F. Hale, Bear Lake.

JOHN N. BRODIE, *Secretary.*

BEAR LAKE, March, 1887.

FARMERS' INSTITUTES.

During the past winter the following institutes were held under the authority of the State Board of Agriculture:

Grayling, Crawford Co., Jan. 31 and Feb. 1, attended by Dr. R. C. Kedzie, Dr. W. J. Beal and Prof. Lewis McLouth.

Fremont, Newaygo Co., Feb. 3 and 4, attended by Dr. W. J. Beal, Prof. Samuel Johnson and Dr. R. C. Kedzie.

Hanover, Jackson Co., Feb. 7 and 8, attended by Professors Lewis McLouth, E. A. A. Grange and L. H. Bailey.

Three Oaks, Berrien Co., Feb. 10 and 11, attended by Professors Samuel Johnson, A. J. Cook and E. A. A. Grange.

Bancroft, Shiawassee Co., Feb. 14 and 15, attended by Professors A. J. Cook and E. J. MacEwan.

Charlotte, Eaton Co., Feb. 16 and 17, attended by Professors L. H. Bailey, jr., E. J. MacEwan and R. C. Carpenter.

President Willits and Secretary Reynolds attended each of the institutes.

[NOTE.—Except for the Grayling Institute, most of the discussions of all the Institutes will be found following the articles which called them out, and these articles may be found by reference to the index at the back of the book: thus the discussion on silos, which followed Prof. Johnson's article on creameries at Fremont, will be found by reference in the index to Johnson or to Silo.]

GRAYLING INSTITUTE.

As the discussions and papers presented at this institute were almost wholly on the subject of the needs and capacities of the pine plains of Michigan, the entire matter is presented together in its original connection immediately following this general review of the series of institutes.

FREMONT INSTITUTE.

PROGRAM.

THURSDAY, FEBRUARY 3—AFTERNOON SESSION, 2 O'CLOCK.

Music.
Prayer.
Music.
"Coöperative Creameries," by Prof. S. Johnson.

EVENING SESSION, 7 O'CLOCK.

Music.

"How to Interest the Young People on the Farm," Mrs. M. W. Scott and Mrs. G. W. Nafe.

Address by President Edwin Willits.

Music.

FRIDAY, FEBRUARY 4—MORNING SESSION, 9:30 O'CLOCK.

"Under Draining," by A. E. Upton.

"Gardening and Small Fruits," by H. C. Reynolds.

AFTERNOON SESSION, 2 O'CLOCK.

"Grasses," by Prof. W. J. Beal.

"Production of Comb Honey," by G. E. Hilton.

"Bees and Home Surroundings," Wm. Gould.

"Agricultural Implements," by G. E. Hain.

"Live Stock," by M. W. Scott.

EVENING SESSION, 7 O'CLOCK.

"The Problem of the Plains," by Dr. R. C. Kedzie.

General Discussion and Remarks.

Executive Committee.—G. E. Hilton, G. W. Nafe, H. J. Dudley, G. E. Hain, J. B. Jewell, M. W. Scott, A. E. Upton.

The article by Mrs. W. Scott on "How to Interest the Young People on the Farm" was generally considered the best article of the Institute, and will be found in full later in the volume.

There was a variety of articles exhibited on the Fremont platform, among others:

By Mrs. Phœbe Hall, a roll of naturally high colored Jersey butter.

By Prof. Johnson, samples of ensilage and of thrashed corn-fodder and corn.

By Mr. A. E. Upton, specimens of drain and sewer tile, joints, angles, etc., and of implements for ditching and laying tile.

And by Mr. G. E. Hilton, a large assortment of bee-keepers' apparatus.

The following preamble and resolutions, presented by Prof. Johnson, were unanimously adopted:

THE MILLER PLEURO-PNEUMONIA BILL.

WHEREAS, The prevalence of contagious pleuro-pneumonia among cattle in the vicinity of Chicago, the greatest cattle market in the country, greatly endangers the cattle interests of Michigan, as well as of the whole country, making it an absolute necessity that stringent measures be adopted to completely eradicate this disease from the United States; therefore

Resolved by the Farmers and Stockgrowers of Newaygo County, in Institute Assemsembled, That we earnestly request the Senators and Representatives in Congress to favor the early passage of the "Miller bill," the purpose of which is to stamp out contagious pleuro-pneumonia and other contagious diseases among cattle in the United States, and that the Secretary be instructed to forward a copy of this resolution to each Senator and Representative in Congress.

The Fremont Indicator pronounced the institute a "grand success." Its final session closed with the adoption of the following report of the committee on resolutions:

Resolved, That in attending this institute we have had a jolly good time; that it has been an occasion of substantial value to us as farmers, and that our thanks are due to all those who have exerted themselves to contribute to this result, and that we can assure them of hearty appreciation of their efforts.

Be it resolved, by the Newaygo County Farmers' Institute, That we would respectfully urge upon our Representatives in Congress to make most earnest effort to secure the passage during this session of Congress of a bill now on their Speaker's desk, known as Senate bill No. 372, being a bill for the establishment of Agricultural Experiment Stations.

Resolved, That our secretary be instructed to send a copy of the above resolution to each of the Michigan Representatives in Congress.

Resolved, That we organize ourselves as the Newaygo County Farmers' Institute Association, of which Hon. J. B. Jewell shall be the President for one year, and Mr. Geo. E. Hilton secretary for one year; and that it shall be the duty of the president and secretary to arrange for the holding of a Farmers' Institute at some point within the county each winter hereafter.

HANOVER INSTITUTE.

OFFICERS.

President—W. J. G. Dean, Hanover.
Vice President—Hon. A. N. Howe, Hanover.
Secretary—H. G. Reynolds, Agricultural College.

PROGRAM.

MONDAY, FEBRUARY 7—AFTERNOON SESSION, 1 OCLOCK.

Music.
Prayer, Rev. D. W. Parsons.
Music.
Address of Welcome, D. W. Peabody, President of Hanover village.
Response, President Willits, Agricultural College.
"The Kind of Farming that Pays," Hon. George A. Smith, Somerset.
Discussion, Opened by M. H. Ray, Concord.
"The Farmer's Education," J. Weston Hutchins, Pulaski.
Discussion, opened by Prof. McLouth, Agricultural College.

EVENING SESSION, 6:30 O'CLOCK.

Music.
"Multiplication of Plants," Lecture, with Magic Lantern Illustrations, Prof. Bailey, Agricultural College.
Questions.

TUESDAY, FEBRUARY 8—MORNING SESSION, 9 O'CLOCK.

Music.

"Progress in Agriculture," C. H. Goldsmith.

Cattle Discussion—"Shorthorns," J. S. Flint, Somerset, "Jerseys," W. J. G. Dean, Hanover. Other Breeds.

"Women's Work on the Farm," Mrs. A. A. Freeman, Hanover.

Sheep Discussion—"Fine Wools," R. D. M. Edwards, Liberty, "Mutton Breeds," L. S. Dunham, Pulaski

"Industrial Education," Prof. McLouth, Agricultural College.

Discussion, opened by President Willits.

AFTERNOON SESSION, 1:30 O'CLOCK.

Music.

"The Horse's Foot in Disease and Health," Dr. E. A. A. Grange, State Veterinarian.

Questions.

"Breeds of Swine," D. P. Jacobs, Concord.

Essay "Two Pictures," Mrs. M. Bidwell.

EVENING SESSION, 6:30 O'CLOCK,

Music.

Address, President Willits, Agricultural College.

Question Box.

Closing Exercises, Resolutions, etc.

The session began and continued under the accompaniment of floods of rain which, however, proved powerless to prevent a large attendance.

The hall at first provided was found far too small, and for the second and later sessions the audience gathered in and comfortably filled a good sized church.

The article by Mr. J. Weston Hutchins, of Pulaski, on "How Farmers May Educate Themselves," is worthy of special mention, and will well repay perusal by any one interested in the subject.

Besides the regular papers and discussions upon them, which will appear in another part of this volume, the last session was enlivened with the following product of the

QUESTION BOX.

1st. Should farmers lessen production in order to advance prices?

Prof. McLouth: Large crops with low prices are more profitable than small crops with high prices.

Mr. Willis of Moscow: The abolition of liquor and tobacco would leave more money to raise the price of farm produce.

Lee Conklin: Farmers should organize and oppose monopoly.

C. H. Goldsmith: Amen! small farmers are unable to hold crops for higher prices except by organization.

2nd. Is it for the interest of the farmer that the crop reports should be taken each spring by the supervisor?

Hon. A. N. Howe: The crop report at present is an injury to farmers. Reports from supervisors are very inaccurate. Sometimes they exaggerate yields and sometimes for an object they underrate them. Often by means of them it is attempted to affect the Boards of Equalization and unjustly influence their determinations.

Lee Conklin: The crop reports cost more than they are worth. They get into the hands of but few farmers and are useful to organized monopoly.

Pres. Willits: Has Mr. Howe any better plan for taking the reports?

Hon. A. N. Howe: No.

Pres. Willits: Has there ever been an overestimate in the aggregate?

Hon. A. N. Howe: Yes, in this town.

Pres. Willits: Perhaps; but not in the State as a whole. In general, crops exceed the estimates. We need some basis on which to form our judgment of the price our crops should bring. The oil producer is anxious to know the aggregate output of all the oil wells and it is important for the farmer to have similar data for his business. Our present law is an effort to secure this. Local organizations can help in making it more efficacious.

Hon. A. N Howe: The monthly report from the Secretary of State's office is all right. It is the annual spring report from the supervisors to which I object.

3rd. Do some plants poison the soil?

Prof. Bailey: No, plants do not excrete, as was once supposed.

4th. Is fall plowing good for sandy soils?

S. A. Strong: I never received any benefit from fall plowing.

Mr. Wetmore: It used to be thought that fall plowing destroyed cut worms by freezing, but that is not so.

Mr. W. J. G. Dean: You can get rid of cut worms by pasturing for a year before plowing for corn.

Mr. Wetmore: Birds are our best friends in fighting cut worms. I value blackbirds very highly for this purpose. I spread corn on the ground to attract them and they take the cut worms in preference to the corn.

Mr. Beadle: If you do not plant your corn in the hollow made by the marker, but a little to one side of it, the cut worms will follow the mark and miss the corn.

Mr. Maynard: I plow very late to avoid cut worms. They will work in fresh sod in preference to corn. I don't believe in pasturing.

THREE OAKS INSTITUTE.

PROGRAM.

THURSDAY, FEBRUARY 10—EVENING SESSION, 7. P. M.

Music.

Prayer.

Address of Welcome, Hon. Henry Chamberlain.

"Industrial Education," Pres. Edwin Willits.

FRIDAY, FEBRUARY 11—MORNING SESSION, 9:30 A. M.

Music.

"What Shall we do to Make Farm Life More Attractive," Thos. Mars.

"Construction of Highways," A. L. Drew.

"Injurious Insects," Prof. A. J. Cook.

Question Box.

Afternoon Session, 2 P. M.

Music.

"Education of the Agricultural Classes," A. Sherwood.

Farm Drainage.

"Farm Department Experiments at Agricultural College," Prof. Samuel Johnson.

Question Box.

Evening Session, 7 P. M.

Music.

Horticulture.

"The Horse's Foot in Health and Disease," Prof. E. A. A. Grange.

Question Box.

Music.

Committee of Program.—W. K. Sawyer, E. K. Warren, E. G. Ingersoll.

Hon. William Chamberlain extended a cordial welcome in the following address:

Ladies and Gentlemen.—The very pleasant duty of welcoming the Farmers' State Institute to Three Oaks has been assigned me by the committee in the absence of my brother, who was expected to make this address.

It gives me great pleasure to have the honor of welcoming you, Mr. President, and your associates of the State Agricultural College to this village, and in behalf of its citizens I extend to you and all of the gentlemen and ladies who have come to aid us in this meeting a cordial and hearty welcome to our village and to the hospitalities of our homes, and beg to assure you we shall do all in our power to make your stay with us both pleasant and agreeable, and we have promised ourselves to be greatly benefited by your presence with us.

The farmers of Michigan to-day need to adopt the very best methods of agriculture possible, and use all the means in their power to make their vocation a success. The State Agricultural College invites our sons to seek the knowledge it is able to impart through its able corps of professors who have made the science of agriculture their study, and are thus able to furnish our young men a field of useful knowledge in this science that would take years of experiment and a large sum of money to obtain elsewhere.

The State Board of Agriculture are doing a good work in holding these institutes in different parts of the State, and by the discussion of the various topics presented furnish food for thought and make suggestions that aid us in adopting more advanced methods of agriculture and horticulture.

Our people will be interested in this meeting and have looked forward to it in view of the valuable information they would obtain.

It may interest you to know something of this village and its surroundings. Its name was suggested by three large oaks that stood side by side near the center of the village—the only ones of the kind for some distance around. They have, however, passed away, like most of the giants of the forest of that day.

This township was organized in 1855 from part of the township of New Buffalo, and for many years this region was known as the Gahen woods. Horace Greeley, in passing through here at an early day, said that the men who lived in these woods and made farms out of these lands were as deserving of a pension as were the survivors of the Revolutionary war. Some of us would be glad to see Horace's suggestion become a law in this day of almost universal pensions. These wood lands have become to-day fruitful fields, producing good crops of hay, grain and fruits, and the flocks and herds that graze upon them grow fat from the excellent grasses they produce.

This village until recently has been known only as a spirited business place sustained by its wood, lumber and farming trade; the territory tributary to it comprising several townships in this county, and reaching out over the line into the northern part of Laporte county, Indiana. We are on very friendly terms with our Indiana friends and like to have them come to our village to do their trading, and the young people find it very convenient to come over here when any of them desire to be united in wedlock. Somehow our ministers have a way of doing the thing more satisfactorily than they do on the other side of the line, judging from the number that come.

While we are outranked by many other villages in the State in population, Three Oaks stands second only in the State—as you approach it from the west. We have, however, the honor of being the first place in the world where the quill of the turkey is brought into successful competition with the bones of the whale in furnishing a useful article of commerce, known as featherbone, with the most flattering prospect that the turkey will win the race.

This new discovery and new industry furnishes a market for a large amount of heretofore waste material, grown by nearly every farmer of the land, increasing the value of his turkey, furnishing employment for labor, and increasing the material wealth of the country.

We are proud to claim this invention as one that originated and has been carried to success by one of our citizens.

We invite you to visit our factory during your stay with us, and see what is being done with the 75,000 pounds of quills collected here last year.

Our people are also interested in education and moral and religious instruction. We have good schools and six religious societies are represented by as many churches. Our village has no debt, our public buildings are all paid for. The village and the country are improving every year. We have never bred or raised a pauper or criminal in the township since it was organized, to my knowledge. Our people are in comfortable circumstances, neither rich nor poor, but alive to progress and seeking happiness and contentment in this our rural village of Three Oaks, and to this people and to their homes I again bid you a hearty welcome.

The institute was made enjoyable by the hearty hospitality extended by the citizens which will be long remembered by the visitors. By invitation an examination was made of the featherbone works of Mr. E. K. Warren, in which the ribs of turkey and other quills are turned to good account as a most effective substitute for whalebone for making whips, corsets, etc.

The closing feature of the Institute was the opening of the

QUESTION BOX.

1st. Is clover, timothy or wild hay best for sheep?

Prof. Johnson: Clover.

2nd. What wages can we afford to pay at this season for farm help?

Mr. Wm. Chamberlain: An average for the past season would be $16.00.

3rd. Should sheep in pasture be sheltered in summer?

Prof. Johnson: It is hardly practicable or necessary unless for coarse wools. Open sheds may be useful for them. In winter shelter should be provided for all. Breeding sheep need a good deal of exercise, but fatting sheep need very little.

4th. Can the English sparrow be got rid of?

Prof. Cook: The English sparrow certainly drives out more useful birds. I know no better method of fighting than trapping and eating.

5th. What will cure a shoulder gall of long standing?

Dr. Grange: Excision—*i. e.*, cutting it out.

6th. Do the patent laws need modification?

Pres. Willits: There has been a great deal of clamor against our patent system, some of it entirely unjust and some with good grounds. There are those who even go so far as to advocate the entire abolition of the system, but it seems to me to serve as a most powerful stimulus to the development of useful devices and it is only right that the man who withdraws himself from other work for the purpose of studying out problems for the benefit of the race, should have some property in his ideas that will give him a cash return. The foundation principle of the system is that a man may have as clear a property right to his ideas as to his horse, and that he is as much entitled to protection in the enjoyment of the one as of the other.

It is undoubtedly true that many swindling schemes grow out of these laws, but did you ever know a man to be bitten in this way by buying of a regular dealer? The greatest trouble arises from the penalty for infringement being placed too high. If no more could be collected than the regular royalty, or if no one could recover costs unless judgment were rendered for as much as $20.00, there would be very little chance to swindle farmers or any one else. But a better defense even than that would be the exercise of good sound common sense and to buy only of people who are known and of established reputation.

On the conclusion of the final session,

Mr. Warren, in well-chosen and feeling words, expressed the gratification of the citizens of Three Oaks at the visit of the representatives of the Agricultural College. The spirit and life of the institution had come among them, though the buildings remained at Lansing. The speaker added that the people had honored their visitors with the largest audience that had ever assembled within four walls in Three Oaks.

BANCROFT INSTITUTE.

OFFICERS.

President—E. S. Burnett.

Committee of Arrangements—N. G. Phillips, P. C. Carruthers, L. D. Obert, T. M. Euler, E. S. Burnett, J. W. Martin.

Committee on Music—Martin Wood, Mrs. H. M. Billings.

Committee on Exhibits—E. L. Lyman.

Question Box—In care of E. S. Burnett.

PROGRAM.

EVENING SESSION—MONDAY, 7 P. M., FEBRUARY 14, 1887.

Music.
Prayer, Rev. Richard Lewis.
Address of Welcome, President Burnett.
Response, Prof. A. J. Cook.
Music.
"Sheep Husbandry," L. W. Barnes.
"The Foot of the Horse," Prof. E. A. A. Grange.
Music, Miss Abbie Phillips.

MORNING SESSION—TUESDAY, 9 A. M., FEBRUARY 15.

Music.
Prayer, Rev. C. B. Clark.
"Farmers' Clubs," F. M. Shepard.
"Improved Stock." J. W. Hibbard.
Essay, Miss Mollie Carruthers.
Music, Miss Florence Wilcox.
Address, Gov. Cyrus G. Luce.
Question Box.

AFTERNOON SESSION—TUESDAY, 1:30 P. M., FEBRUARY 15.

Music, Miss Lola Parsons.
"Injurious Insects," Prof. A. J. Cook.
Recitation, Miss Stena Billings.
Music.
Question Box.

EVENING SESSION, TUESDAY, 7 P. M., FEBRUARY 15.

Music.
"Corn Culture," E. J. Cook.
"The Farmer Should be Educated," E. A. Burnett.
Music.
"Literature in the Home," Prof. E. J. MacEwan.
Music.
All Subjects open to Discussion.

A fine display of grains and vegetables occupied part of the rear end of the hall, and an audience that at one time numbered fully 500 filled all the remaining space.

The program was carried out substantially as given above, and at the close a resolution to make the institute an annual affair was unanimously adopted.

Governor Luce being called on for a few remarks responded as follows:

Mr. President and Fellow Citizens of Shiawassee County:

I propose to speak to you on the needs of Michigan farmers and their families. The geographers of 70 years ago describe the area between Lakes Michigan and Huron as one vast swamp wholly uninhabitable for white men; but to-day this stone, so rejected by the early builders of our country, has become the head of the corner, and in all that goes to make a State great and prosperous and happy, Michigan stands in the front rank.

There is no agricultural State in the nation that produces as many dollars per acre as Michigan.

No State has a more intelligent population or grander institutions. It was more than fifty years ago that I came to my present home. At that time we had there the wolves and the Indians for our neighbors, so you see that in speaking of your needs I am speaking from my own experience. But our needs to-day are different from those of forty years ago. We need now many things that were of little account to us at that time. Then the individual was of greater account than to-day. His strength of arm and skill of hand were needed to fell the forest, reap the crop, and to do by hand all those various things which are now done by machinery. To-day we write by machinery, we talk by telephone, we mow and reap with machines, we load and unload our hay with machines, in short we almost live by machinery, and it is necessary for our welfare and to hold our proportionate influence in the affairs of the world that we should adapt ourselves to these changed conditions. It needs more skill, more knowledge, more brain power to use successfully these varied appliances than were needed merely to use our muscles. The greatest and most effective of our machines is coöperation and organization whereby we progress with the impetus of numbers. No class is so slow to appreciate the value of this aid as the farmers. Now I care not whether this organization be the club or grange, or what it be, so that the work be accomplished. We need these agencies to increase our knowledge. I assert from my acquaintance and experience that there is no occupation requiring a broader or deeper knowledge than the proper managment of a farm. Now the reason why a farmer needs to know more than most men is that we deal with the unexpected. We cannot control our surroundings, and we need to be quick and ready in order to adapt ourselves to our conditions.

You have just paid your taxes and they have doubtless seemed heavy, but I dare venture that more is wasted on the farms of this county by mismanagement every year than would pay your taxes twice over. * * *

Now, lawyers and doctors are able to go straight to their books to prove their cases, but you, farmers, can not settle your problems so easily; you can not tell what it is going to cost you next year to raise a bushel of wheat. You ought to know what it did cost you last year, and from the collective experiences of the past you can form some estimate for the future. But even the best of estimates may be wholly wrong. * * * * *

In Cass county the other day I heard a paper read on how to restore exhausted soils. I shuddered to think of Michigan soils being exhausted. A farmer who wears out his soil is not far from total depravity. We own our soils it is true by government patent, but we live here but a short time, and we owe it to our successors to fertilize these fields and leave them as good as or better than we find them. Four years ago I paid a visit to my birth-place. I reached it at sundown in the fall. The hill was smaller than I remembered it, the brook was dry. The farm was for sale. I asked the price, it was $20 per acre or $18 cash. I asked the trouble. The man said, "It's worn out. It is a clay and bakes hard. It won't grow grass nor anything good, but only a coarse weed."

I went out on the farm and saw that it needed brains mixed up with the soil. It was suffering for under-draining.

Theory is good but facts are better.

My father came from Connecticut and used to tell of the worn-out fields of Connecticut. My mother came from Virginia, and her father used to tell me of the worn-out fields of Virginia—"worn out raising tobacco and niggers." So when I began to farm it was with a solemn vow that I would not wear out that land. At that time the "Michigan Farmer" was edited by Mr. Isham, and he advised drawing out manure in piles and plowing it in in the rain or at night, and in my early zeal, without knowledge, in obedience to the Farmer, I actually plowed under manure in the night and in the rain until my horses were galled. The next year where my piles of manure had been my wheat stalks laid perfectly flat and there was no wheat in them either. So this theory did not work, and I found that we need the comparison of experience to correct our theories and provide us with common sense.

Now farmers, stimulate each other to raise grass and to compel two spears to grow where one grew before, to leave some of the original forest trees, to beautify nature, to draw out your manure and spread it when you draw it, and in every way to keep to the front in your profession.

I see in the audience before me two young men who contemplate matrimony within the coming year, and I pray you to take none but the best girl on the earth. I see before me also some young women who have thought somewhat on the same subject, and I pray you also to take none but the best and certainly to take no young man who needs to eat cinnamon and cloves lest you should know where he has been.

Another thing farmers need is less of toil for themselves and their wives. More of social life is needed. A great change has come over our farming communities in the last fourteen years in the relation of the farmers and their wives to social and political life, and I attribute much of this change to the work of the Granges throughout the country.

There are certain laws which bear unequally on different classes. For instance, as the laws are now the farmer pays more than his proportionate share of the taxes.

If the merchant or manufacturer finds an extra burden bearing upon him from some law he is able to charge it over as an additional expense on his wares. But the farmer is not able to do this, and so we are more largely interested than most classes in seeing that our laws are just and equal.

Among the worst of these are our patent right laws. I believe that the inventor should be paid, but what justice is there in a law which enables one invention to reap a reward of $62,000,000, as the Westinghouse air brake has done?

This law places unnecessary burdens on the people. Burdens never displace themselves and are rarely displaced by those who profit by them. They must be removed by those who feel the pressure.

Everything is patented; there are 800 patents on plows, 700 on stoves, 300 on fences, and so on *ad infinitum*.

You don't realize the burden of our patent system. You remember the patent on the slide gate. A man bought the patent for $1.00 and started out to collect $100,000. They undertook to raid the State and collect their royalties from every user of the gates; until their iniquitous scheme ran against our farmers' machine, the Grange, and was beaten.

So, the well patent collected more money for royalties in Indiana because they had no farmers' organization than all those organizations have cost in all our country.

They tried it in Michigan, and again our machine of coöperation defeated them.

Singly and alone a man is like a cipher away on the left hand of nothing. He can't take care of his family.

My specialty is fattening animals. I raised the biggest steer ever grown in the State. He was sold when just five years old and weighed 2,800 lbs. This steer was in the barn near home, and we fed him a little meal each day. The body of our animals were together in another field. One day we turned the big fellow in with the rest and were compelled to rescue him from the combined attack of the entire herd. We then took the leader of the herd in a field alone with the big steer and he was quickly whipped by him, and we tried the same with several of the most pugnacious and, one by one, they were each whipped. But when we again, after this experience, turned the big steer in with the herd they all united against him and would soon have killed him had we not rescued him again. And so, farmers, we are like the herd of steers. One man alone is not very strong, he is easily whipped, but in coöperation with his fellows he is irresistible. In organization is our strength, and that combination which makes the most of our possibilities, which gives us the mutual support of our whole body, is the greatest need of the American farmer to-day.

Adjourned.

CHARLOTTE INSTITUTE.

PROGRAM.

Wednesday, February 16, 2 P. M.

Music—"Let All Rejoice," Anthem.
Prayer.
Address of Welcome, Hon. Geo. Huggett, Mayor of the City of Charlotte.
Music—"Beautiful Friend," Quartette.
"The Horse's Foot in Health and Disease," Dr. E. A. A. Grange, Agricultural College.
Discussion.
Music—"In the Morning by the Bright Light," Quartette.
"Small Fruit for the Farm and Garden," J. W. Gibson, of Bellevue.
Discussion.
A Paper—"Women's Employment," By Mrs. Geo. A. Perry, of Charlotte.
Music—"Come Where the Jam Pots Grow," Quartette.

Evening Session, 7 P. M.

Music—"Oh Restless Sea," Trio.
Prayer.
A Paper entitled "Ourselves," by Dr. Mary E. Green, of Charlotte.
Music—Medley introducing sixteen melodies, Quartette.
"Sheep Husbandry," S. C. Tarbell, of Kalamo.
Discussion.
Breeds of Cattle, illustrated by Stereopticon, Dr. Manly Miles, Lansing.

Music—"Golden Years," Quartette.

THURSDAY, FEBRUARY 17—MORNING SESSION, 9 A. M.

Music—"Rocking on the Billows of the Deep," Quartette.

Prayer.

"Contagious Diseases of Animals," Dr. Manly Miles, Lansing.

Discussion.

The balance of this session will be occupied in the discussion of the dairy question. Papers will be read in the Cheese Factory interest by Walter Bordwell, Esq., of Olivet, and E. F. Preston, of Sunfield; in the Creamery interest by parties who have been patrons of that branch of the dairy business, and the merits of condensing milk as a means of profit will be presented by J. W. Ewing, Esq., of Oneida. A general discussion will follow the reading of papers and it is expected that this session will be of greater interest than any other of the Institute.

AFTERNOON SESSION, 2 P. M.

Music—"Don't Leave the Farm, Boys," Quartette.

Prayer.

"Rotation of Crops," Alden Swift, Kalamo.

Discussion.

Music—"The Sailor's Return," Quartette.

A Paper entitled "Faces," Mrs. O. J. Carpenter, of Dimondale.

Music—"Stand by Your Friend," Quartette.

"Stock Raising as Applied to Farming," A. D. Bank, of Delta.

Discussion.

Music—"Go to Work and Build a Home," Quartette.

EVENING SESSION, 7 P. M.

Music—"Hope Beyond," Duet.

Prayer.

"The Relation of the Schools and the Home to Good Literature," Prof. E. J. MacEwan, Agricultural College.

Music—"Where the Jam Pots Grow," Quartette.

"The Agricultural College," President Edwin Willits, Agricultural College.

Music—"The Old Home Ain't What it Used to be," Quartette.

Music under the direction of Thos. Carey, assisted by a quartette.

Pianist—Miss Edith Hazlett. *Violinist*—Vol. Palmer. *Cornetist*—Miss Adah Henry.

Committee of Arrangements.—Frank N. Green, President; Peter Horn, Treasurer; Seth Ketchum, Secretary; Joseph Shaw, A. F. Claflin.

This, the final institute, was the fourth consecutive one ushered in with heavy rains, and it furnished the fourth instance to prove that rains are good for institutes as for other agricultural products, for the fine auditorium of the county building was well filled from first to last.

The papers of Mrs. Dr. Mary E. Green and Mrs. Geo. A. Perry, both dwelling chiefly on the better fitting of girls for life, so that it may be a joy to themselves and of value to others, were especially interesting.

Mayor Huggett, on behalf of the city and county, extended a cordial welcome to their guests. He said:

We greet you because of the purpose for which you are assembled. Whatever tends to elevate or improve agriculture raises and dignifies the race. Rome was in her palmiest and purest days when the highest commendation that could be bestowed upon a citizen was that he was a good husbandman; and when the tilling of the soil was turned over to the tenant and the bondsmen we mark the period of her decay.

Throughout the dark ages those who tilled the soil were in a most deplorable condition. Agriculture was a menial and degraded employment. Its progress toward a better state was slow, and never received any real impulse until within the last century. In 1783, through the influence of Sir John Sinclair, a Scotch agriculturist and member of parliament, the British Board of Agriculture was organized. It brought men together from every part of the kingdom. There was a general interchange of opinions, and questions of importance were thoroughly discussed. Through the encouragement of this board the elements of the soil were investigated and the science of chemistry was applied to the improvement of agriculture. This was a beginning of real progress in the art. Since that time the need of applying intellect to agriculture is generally acknowledged.

The rapid strides by which it is being carried to perfection in this land of ours is manifested on every hand. Your own county is not past the time, since its organization, that marks the middle age of a human life. Yet what wonderful progress has been effected. The dense forests that half a century ago covered its soil, and were the haunts of wild beasts, have given place to well cultivated fields which yield rich harvests of grain or pasture. Finely bred flocks and herds, and substantial homes make beautiful the landscape in every direction, while two fine little cities and six flourishing villages have risen with you, and supply markets and facilities for communication with the outside world. * * * * *

The true dignity of the farmers of our land is not derived from the fact that they till the soil, a serf may do that, but rather from the fact that he is the owner and proprietor of the soil he tills.

It follows that when a boy is properly advised to remain a farmer and to build a home as such, it must be with the understanding that he is expected to become the owner of a farm. But how our farmer boys are to provide themselves with farms of their own, will soon be one of the most serious questions that the people of this country will have to consider.

Formerly, when the home farm became crowded by the number of grown up sons, it was no very difficult matter to provide for each from the cheap lands near at hand. But now we see young men going half across the continent to find lands which they can pay for, and these are not the most desirable, but only such as the speculators have thought not worth attention.

Should they undertake to procure a home by purchasing high priced or improved lands upon credit they would most likely fail, or if successful it could only be after a long struggle and with good crops and prices.

We listen with attention to those who recount the toils and hardships of pioneer life, but the prospect of chopping and clearing off forests to secure an independent home is far less gloomy to contemplate than digging the soil to clear off heavy mortgages.

The consequences may be readily imagined.

If our young men cannot secure lands for themselves they must leave the farm or become merely tenants or farm laborers.

But the nations of Europe give us abundant examples of the evils of landlordism, and the misery and degradation which it has brought upon the people of Ireland are not the lot which we wish for the American farmer.

These fears cannot be considered groundless.

In almost every nation, ancient and modern, the land question has been a vexed and difficult one. We cannot, then, expect to escape all danger. The last census was a surprise to many who had supposed that the farmers of this country, as a rule, owned the soil they tilled. It revealed the fact that 1,024,601 farms were occupied by tenants. This is more than one-fourth of all the farms in the country of three acres and upwards. It is claimed, too, that this number has increased at least twenty-five per cent since 1880. In your own State the census shows something over 15,000 tenant farmers; while the State of Iowa, with fewer inhabitants than our own, and away on the western border, had more than 44,000. Kansas had more than 22,000, and Missouri upwards of 58,000. But the great agricultural State of Illinois with her 80,000 tenant farmers, takes the lead of the whole country. You see our rich farming lands attract the attention of the capitalist. He invests his money in them as a matter of profit. Prices are continually advancing, and the opportunity for men of moderate means gradually diminishing. As this process goes on, the power of the land owner to exact higher rents and to more closely grind the tenant or the laborer daily increases. If it is thought that men can betake themselves to other pursuits, the cities are yet more crowded than the farms. Foreign emigration has much to do with all these silent processes that are shaping the destinies of our people. But whatever may be the result, we have sufficient evidence already to show that wealth is exercising an undue influence in this country. Should it continue to grow in power, it will sooner or later destroy or greatly impair the prospects of young men who have not its favors for almost any pursuit, and none more than those of the farmer boy. In his ambition for a farm that he can call his own without being subject to any superior he will be doomed to disappointment.

The farmers of this country have a deeper interest in this matter than any other class. That independence of character and pride of profession which so distinguishes our genuine farmer, and are such incentives to carry his art to perfection, would never be felt or understood were he not the owner of his own farm and fireside. Whatever, then, tends to impair or demean your vocation deserves your early attention and your earnest efforts to ward it off to save yourselves, your posterity and your country from danger.

The further proceedings of the institute will be found in the form of discussions following the various papers, later in the volume.

GRAYLING INSTITUTE.

THE PINE PLAINS OF MICHIGAN.—THEIR AGRICULTURAL POSSIBILITIES.

PAPERS AND DISCUSSIONS OF THE INSTITUTE HELD JANUARY 31 AND FEBRUARY 1, AT GRAYLING, CRAWFORD COUNTY, MICHIGAN.

PROGRAM.

MONDAY, JANUARY 31, 7 P. M.

Prayer, by Rev. T. Edwards.
Music, Glee Club.
Address of Welcome, by the Chairman.
Music, Glee Club.
Lecture—"The Vegetable Growths Adapted to Cold Climates," Prof. W. J. Beal.
Music, Glee Club.

TUESDAY, FEBRUARY 1, 8:30 A. M.

The following papers will be presented, each followed by discussion:
"Grain Raising on the Plains," J. Steckert.
"Root Crops," Thos. Lound.
"Grass and Forage Crops," J. G. Marsh.
"Corn," N. H. Evans.
"Small Fruits," G. W. Love.
"Plowing," W. C. Johnson.
"Live Stock," H. Head.
"Fruit," Alexander Wayne.

AFTERNOON SESSION, 2 P. M.

"Cultivation of Light Soils," Mr. Van Buskirk.
Lecture—"The Agricultural Problem of the Plains," Dr. R. C. Kedzie.
Discussion, led by Dr. Miles.

EVENING SESSION, 7 P. M.

Music, Glee Club.
Recitation—"The Old Farmer's Experience With a Bicycle," Miss Belle Carson.
Music, Glee Club.
Lecture—"Industrial Education," Prof. McLouth.
Reports of Committees.

Hon. O. Palmer, chairman of the committee of arrangements, outlined the work of the institute in the following address:

Ladies and Gentlemen:

An address of welcome I deem unnecessary. The people here know they are welcome to a meeting which has for its object the advancement of this section of the State. I esteem it a high honor to be called to preside over a meeting of this kind. We are not here for political scheming or theological squabbles, but to compare methods of work, to exchange experiences, to devise means to make the wilderness about us productive and remunerative.

That this can be done I do not question, but the exact method is to be studied. We do not fairly appreciate the real nobility of our calling. If we walk in the footsteps of nature we become ennobled. The daily necessities of our lives may force us into artificial relations, but were nature our constant guide the heart would be uplifted and brain and body be developed to its best possibilities.

The life and home of the farmer is often despised, but if they are what they should be they may have every attribute necessary for the highest happiness. It is in the man more than in his surroundings to make that home and that life what it should be.

The words of a great poet and scholar are as applicable to these temporal as to spiritual things when he says:

"It was, we own, subject of much debate,
And worthy men stood on opposing sides,
Whether the cup of mortal life had more of sour or of sweet.
Vain question this when asked in general terms
And worthy to be left unsolved.
If most was sour the drinker not the cup we blame,
For each within himself the means possessed
To turn the bitter sweet, the sweet to bitter.
Hence from the selfsame corner of the sky
One beauty saw, another hideous sights;
One discord heard where harmony inclined another's ear;
One nectar drank, another bitter draughts.
The sweet was in the taste, the beauty in the eye,
And in the ear the melody; and in the man,—
For God necessity of sinning laid on none,—
To form the taste, to purify the eye and tune the ear.
That all he tasted, saw or heard
Might be harmonious, sweet and fair:
Who would might grow in pain,
Who would might sing for joy."

There is little difference in the dispositions of men whether in town or country. We build the houses wherein we live. How few of us make *homes* for the daily life of ourselves and our families! While we discuss to-night particularly the great practical questions that will be presented to us, I trust we shall not forget entirely the lawn and the flower garden. Let us remember the beautiful as well as the useful. I will not take more of your time, but avail myself of the opportunity to thank you for your presence with us. I see before me representatives from every township in this county, from several townships in the adjoining counties, and representatives of distant counties who are interested in the subject which we are to discuss,—Plains Farming.

Music by Glee Club—"A Summer Shower."

The speaker for the evening was then introduced and delivered the following lecture on

GRASSES FOR PASTURES AND MEADOWS IN COLD CLIMATES.

BY PROF. W. J. BEAL OF THE AGRICULTURAL COLLEGE.

[Read also before institutes at Fremont, Coldwater and Fitchburg and at the State Dairymen's convention at Flint.]

As I understand it, in this portion of our country the summers are short and the soil is usually well mulched with a covering of snow in winter. There is some first rate land, some not so good, and away over in another neighborhood they do say there is some that is "as poor as Job's turkey." This county has a fair proportion of marshes and some land that is rather rough, hilly and broken. The water is abundant, easily obtained, of excellent quality, the climate is healthful and the State in which we live noted for enterprising and thrifty people.

I suppose you are interested in the treatment of stump lands, the best way to prevent forest fires, how to make the best use of timber that is cut and how to take the best care of that which is reserved. You are interested in knowing how to manage the different kinds of soil, that they may not only give a profit in this generation, but may pass in good condition into the hands of your posterity, In a word, you are studying what vegetables to grow and how to grow them, what grasses, clovers, grains and fruits to raise and how to raise them with economy and profit. As this is a cool, moist climate, it should be well adapted to the growing of grasses and clover suitable for feeding flocks and herds. The selection of grasses and their management in pasture and meadow is a broad and important subject, and one which, if properly handled, should always interest the farmers of such a country as this. Good farming, as practiced in some portions of our country, is essential to the best success here, as everywhere, in regard to stock, rotation of crops, etc. You must not expect me to solve all of these problems for you. This will take long years of experience and hard work by the best people in our State. Pioneers will experiment for the benefit of those who are to come after them. Study and experiments will help.

So small and humble a thing as a blade of grass possesses much that is of interest to the farmer as well as to the botanist. It is a most wonderful structure. The lower part of the leaf is called the sheath and clasps the stem of the grass; the flat, upper portion is called the blade. The sheaths and young, overlapping leaves protect the tender flowers which are to produce the seeds. The blades of most grasses are especially adapted for cropping by cattle of all kinds. The tips of the leaves are the oldest portion and are nipped off, but the blade continues to elongate by a multiplication and growth of the cells near its base. In dry climates, or in dry seasons, the epidermis of leaves is thicker, and helps to protect the tender cells within, while in damp or shady places the epidermis is thinner. Leaves roll up or close up, and, to some extent, protect themselves from severe dry or hot weather. In some cases, a covering of hairs helps protect the plant from the severest weather. Details cannot be given at this time. Grasses have flowers as well as the roses and lilies, although they are not conspicuous.

THE FUNCTION OF GREEN LEAVES.

Leaves not unfrequently absorb water in a liquid state as well as in the form of vapor, yet the roots absorb most of the water for plant growth. That leaves sometimes absorb water is most easily tested by observing the revival of cut flowers or plants when placed in a moist tin box.

"The paramount function of the leaf is the absorption and assimilation of carbon, as such does not exist in the atmosphere, unless, indeed, as an impurity in air of towns, and a very prejudicial one to plants." (*Masters.*) The carbon of plants comes from carbon dioxide, and is decomposed through the agency of chlorophyll under the influence of light.

THE PLANT IS A FACTORY.

"All the labor of the plant by which, out of air, water, and a pinch of divers salts scattered in the soil, it builds up leaf and stem and roots, and puts together material for seed or bud or bulb, is wrought, and wrought only, by the green cells, which give greenness to leaf and branch or stem. We may say of the plant, that the green cells of the green leaves are the blood thereof. As the food which an animal takes remains a mere burden until it is transmuted into blood, so the material which the roots bring to the plant is mere dead food until the cunning toil of a chlorophyll-holding cell has passed into it the quickening sunbeam. Take away from a plant even so much as a single green leaf, and you rob it of so much of its very life-blood." Masters, quoted from Gardener's Chronicle.

A living plant is a machine or a factory, which, under the influence of light and heat transforms raw materials into organic matter, suitable for enlarging the plant, or enabling it to grow. In nearly all cases, some portions of a plant are dying while others are growing; and to some extent, one part is independent of other portions. This enables a plant to change its place of growth, to feed on its own stock of nourishment, or to recuperate when injured. The formation and enlargement of new cells constitute growth. To be ready for absorption by plants, matter must be in a liquid or gaseous condition. To a great extent a plant takes what it likes best, or is capable of controlling the quantity of any substance absorbed.

Of the materials assimilated, a part goes at once to form cell walls, cork, mucilage, etc., and can never be changed by the plant into matter for constructing other parts of the plant; while other portions of assimilated material take the form of starch, oil, inulin, and are likely to be again changed and transferred one or more times to other portions of the plant.

Only a very small part of the most fertile soil is in condition to be used for plant food. Some soils may contain a large amount of materials which the plants cannot take, or do not need. A fertile soil is capable of retaining plant food, while sandy soils, owing to their excellent natural drainage, are not fertile unless frequently supplied with manure.

Two different kinds of plants growing in the same field will usually be found to contain certain substances in different proportion. Some are essential, others are not; some in large quantity, others in small quantity, yet, strange as it may seem, by the chemical composition of a plant, we cannot always tell what manures will benefit it most.

From the soil plants obtain, by means of their roots, all their ash constituents, all their sulphur, and nearly the whole of their nitrogen and water. From the atmosphere they obtain, through their leaves, the whole, or nearly the whole of their carbon, with probably small quantities of nitrogen and water. The amount and composition of the ash of succulent plants, as meadow grass and clover, are greatly influenced by the character of the soil and the manure applied.

For most of the above paragraph the writer is indebted to the "Chemistry of the Farm," by R. Warington.

Meadow hay contains a much larger proportion of potash and lime than is found in the ripened grain of the cereals.

The wide variations in fiber and albuminoids must be regarded as being entirely due to physiological causes, which are difficult to explain. *Digitaria sanguinale*, for instance, which in one specimen contains the extreme amount of albuminoids and a small amount of fiber, has, in another, only half as much albumen and one and three-quarter times as much fiber. We learn, then, that species are not in themselves at all fixed in their composition, there being as large variations among specimens of the same as between specimens of different species.

The different sections furnish very different qualities of grasses, and for the reason that those from the north were almost entirely from cultivated soil, while those from the other sections were many or most of them wild species from old sod. The improvement brought about by cultivation is marked, and the difference between a ton of wild western and eastern cultivated hay is apparent.

In general, as a grass grows older, its content of water decreases, ash decreases, fat decreases, albuminoids decrease, carbo-hydrates increase, crude fiber increases, non-albuminoids decrease, until bloom, or slightly after, when it is at its lowest, and then it increases again during the formation of the seed. There are almost no exceptions to the fact that water decreases in the maturer specimens; that is, a plant gradually dries up and becomes less succulent. From these statements we infer that grasses of the better grazing districts, when grown in a dry season, make the best feed, but usually less in quantity. Grasses grown in sunny weather are better than those grown in cloudy weather or in the shade. Grasses grown on marshes or wet land are not so nutritious as those grown on dry land. Grasses grown on rich loam or clay in fine condition are more nutritious than those grown on poor, thin soil.

There are many widely different plants which, in popular language, have the name "grass" attached to them; such as knot-grass, rib-grass, cotton-grass, sea-grass, eel-grass, sedge-grass, the clovers and others, but these do not belong to the family here under consideration. There are many sedges often abundant on marshes, and these are not grasses. The grass family contains Indian corn, wheat, oats, barley, rye, rice, doura, sorghum, broom-corn, sugar-cane, millet, Hungarian grass, bamboo, timothy, red-top, June grass, fowl meadow grass, blue-joint, buffalo-grass, orchard grass, meadow fox-tail, the ferns, rye-grass, oat-grass, sweet vernal grass, Burmuda grass, and many more, which contribute to the food of domestic animals.

Of the staple crops of the United States, the grass family contains about five-sixths of the total value.

The cereals and the pasture grasses, the world over, are of more value to man and his domestic animals than all other plants taken together!

Vastly more than half of the value to man of all vegetation belongs to one family, the grasses. "Grass is king. It rules and governs the world. It is the very foundation of all commerce; without it the earth would be a barren waste, and cotton, gold and commerce all dead." (Solon Robinson.)

"Of the individual plants on the great prairies of the Northwest, 90, yes 99 per cent. are grasses!" (Scribner.)

There are about 300 genera, and 3,100 to 3,200 species. They are most abundant in the temperate zones, where they often clothe large tracts with a growth which is fine, soft and thick.

In the United States, east of the Mississippi, the grasses constitute about one-twelfth of all the species of flowering plants. A State like Michigan, Illinois or Massachusetts has been found to contain not far from 130 species of grass. It is not uncommon in the Northern States to find 60 species within a distance of a few miles of each other.

1. Jungle or Bush Grasses are those which generally grow isolated, in bunches or a few plants here and there. The bamboos are examples for the tropics. In the northern countries many of the smaller grasses have a similar disposition of growing in tufts; of this kind we have *Deschampsia* (*Aira*) *cæspitosa*, L. (hair grass), *Avena pratensis* (narrow-leaved, Oat-grass), *Festuca elatior*, L. (Taller Fescue).

A few others, if sown alone and not very thick, not closely fed or rolled, will assume the same habit. Of such we have *Festuca ovina*, L. (Sheep's Fescue), *Festuca duriuscula*, L. (Hard Fescue), *Dactylis glomerata*, L. (Cocksfoot or ochard grass).

3. The Aquatic or Water Grasses are those which elect to grow by the margins of rivers, in brooks or ditches, or around the edges of ponds. With few exceptions they are of little value agriculturally. Their presence is a sure indication of lack of drainage.

3. The Marine or Sea Side Grasses, which are chiefly found near salt water or the Great Lakes. They are generally very coarse and distasteful to cattle. A great proportion of the plants in these situations, which are cut and cured by the farmers of New England and Long Island, and the Jersey coast, and known as salt marsh hay, are not grasses, but belong to other families of plants.

4. The Meadow or Pasture Grasses. Most of the grasses of much value to agriculture belong to this section. They are the leading grasses of our best meadows, pastures, and the grazing lands of the prairies. Some of these are especially suited to upland pastures, thin soils; poor, stiff soils, hungry clays; rich, deep loams; meadows on the banks of rivers, subject to perennial floods; irrigated meadows, in which the water can be entirely controlled.

The Agrarian Grasses are more properly those which occur in land under tillage.

Native grazing lands in the West soon change for the worse when they are closely fed by animals; especially is this the case in dry climates. Weeds take their places unless care is taken to introduce cultivated species.

LIST OF GRASSES FOR THE NORTH.

The speaker approaches this subject with some want of confidence on account of the great diversity of soils, climate, and uses, the lack of well conducted and accurately reported experiments. He will, therefore, not puzzle the farmers with numerous long lists of mixtures, on a guess, but give a few of the best and advise experimenting for themselves. A point is gained when a farmer ventures to deviate from the long established customs of his fathers or his neighbors, many of whom have fallen into certain practices without very good reasons therefor.

In selecting seeds for alternate husbandry, only those grasses and clovers should be sown which rapidly make a large growth, and arrive at maturity in a short time:

Grasses and Clovers for Cne Year.

Dactylis glomerata (Orchard grass).
Zea Mays (Indian corn).
Secale cereale (Rye).
Avena sativa (Oats).
Panicum miliaceum (Millet).
Setckia Italica (Hungarian grass, Bengal grass, sometimes called Millet).
Lolium Italicum (Italian rye-grass).
Arrhenatherum avenaceum (Tall oat-grass).
Trifolium pratense (Red clover).

Grasses and Clovers for Two Years.

Dactylis glomerata (Orchard grass).
Phleum pratense (Timothy), heavy and loamy soils, not on sand.
Arrhenatherum avenaceum (Tall oat-grass).
Festuca elatior (Taller fescue), heavy and loamy soils.
Festuca pratensis (Meadow fescue), heavy and loamy soils.
Lolium perenne (Perennial rye-grass).
Trifolium pratense (Red clover).
Trifolium repens (White clover).
Trifolium hybridum (Alsike clover).

Grasses and Clover for Three or More Years.

Dactylis glomerata (Orchard grass).
Arrhenatherum avenaceum (Tall oat-grass).
Festuca elatior (Tall fescue).
Festuca pratensis (Meadow fescue).
Alopecurus pratensis (Meadow fox-tail).
Phleum pratense (Timothy), for mowing only.
Poa pratensis (June grass, Blue grass of Kentucky), for pasture only.
Agrostis vulgaris (Red top), for rich loam or low land.
Lolium perenne (Perennial rye-grass), (not over four years), the larger varieties.
Trifolium pratense perenne (Perennial red clover, Cow grass of the English).
Trifolium hybridum (Alsike Clover).
Trifolum repens (White clover), for pasture only.

Grasses for Marshes.

Agrostis vulgaris (Red top).
Festuca pratensis (Meadow fescue).
Festuca elatior (Tall fescue).
Poa serotina (Fowl meadow).
Poa pratensis (June grass, Blue grass of Kentucky).
Alopecurus pratensis (Meadow fox-tail).
Deyeuxia (*Calamagratis*), *Canadensis* (Blue joint).

TIMOTHY (PHLEUM PRATENSE).

This is the best known, most extensively sown, and one of the most profitable grasses of any in the United States. In Pennsylvania and some other States, *Agrotis vulgaris* is called "herd's grass," while at the north this is known as "red top." There are several other grasses called "cat's tail" in different portions of our country. The first common name comes from Timothy Hanson, of Maryland, who introduced the grass from England about 1720. The next name comes from a man by the name of Herd, who found it growing in New Hampshire and began its cultivation.

In 1760 or '61, Peter Wynch took seeds of it from Virginia to England. It is a native of Europe, and very likely also indigenous to some portions of the United States. It is widely distributed in north Africa, western Asia, and other portions of the world. Timothy is a perennial not likely to be mistaken for any other grass, and in fact this is about the only one that is generally known by all farmers.

The leaves are short and flat, and on good soil the stem is from two to four or mere feet high, each bearing one stiff, erect, rough spike, long, and as thick as a lead pencil. The plant is rather coarse to the touch and sight.

Having a large bulk of stems, with few leaves, the hay wastes but little in transportation. The grass stands up well, the hay is easily cured, heavy for its bulk, presents a good appearance, and suffers less than many other grasses when allowed to go to seed before cutting.

Every one in town and country knows the grass as soon as he sees it, and can distinguish it from all others, hence a leading reason why it is raised, fed and sold. Consumers buy timothy, and fear to buy anything else, even though it were better, because they do not know what it is. They will buy even if it is dead ripe.

The same remark applies to a well-known and popular grass, perennial rye grass, generally raised in England. After a long time if a grass or fruit becomes well known, and it has good qualities if not the best, people buy it because they know what they are getting.

In this country timothy is often sown alone, at the rate of about eleven pounds to the acre. The sowing usually occurs in autumn with wheat or rye, or in the spring with oats or barley. It is often sown as the only forage crop on moist land or on strong, clay loam, but on lighter land it is usual to sow on some red clover also. If quite sandy, clover without any true grass is generally sown. Timothy is two to four weeks behind red clover in coming into flower ready for the mower. Among its other good qualities, timothy seeds very freely, yielding six to ten or more bushels of cleaned seed to the acre; and this is easily saved and threshed with a flail or a machine, can be easily cleaned and separated from seeds and weeds, and can be put onto the market in abundance and sold cheaply. It only takes from one to two pecks to sow an acre, and this costs but little.

While timothy has many good qualities to recommend it, it has many marked defects. When sown with clover, it makes but a small growth and must be cut young, if the clover is secured in good season. It starts very slowly in spring, is a long time in coming into flower, and after cutting the second growth is slow, feeble, and of little consequence, seldom large enough to cut a second time or to afford much pasture. If cut early the tuber at the base of the stalk does not become sufficiently matured to keep the plant alive and healthy. If cut close, the tuber is cut off, and the plants suffer and become feeble, and perhaps perish.

It is hardly suited for pasture at any time, unless it is kept quite large. Horses, sheep, and especially hogs, must not be allowed to eat it close to the ground. In England it stands pasturing in spring without much injury to the hay crop. Besides these objections, timothy is likely to be short-lived; the tubers are easily trodden out by cattle, killed by drought or frost, or eaten by mice or gophers. It sometimes rusts badly. It is not hard to kill when cultivating for another crop; it starts quite readily from the seed, and is well suited for one good crop of hay in a season, but is not well adapted for pasture. It is not as well liked in Kansas and vicinity and in the South as it is in the Northeast.

ORCHARD GRASS (DACTYLIS GLOMERATA).

For the past fifteen years or more the writer has been accumulating notes and making observations and experiments in reference to our most noted grasses, and concerning none of the true grasses has there been more said or written or more inquiries made than about the one above named. Like every question capable of dispute, this one has two sides, and shrewd men of the same neighborhood often differ very much in their estimation of orchard grass.

The grass is perennial, lasting for many years, two or three, or even five feet or more in height, rather large, coarse, rough, of a light green color, and grows in dense tufts unless crowded by thick seeding. The lower leaves are sometimes two feet or more in length. The clustered spikelets make dense masses on the small spreading panicle; the flowers appear with those of early red clover.

It is a native of Europe, and is also now found in North Africa, India, and North America, and perhaps in other countries. Although it came to this country from Europe, it did not attract much attention in England until sent back there in 1764 from Virginia.

So far as quality is concerned, if cut in season or pastured when young it stands well the test of cattle and the chemist. It is very nutritious, the seeds start quickly and make a vigorous growth, and if the grass is not a very valuable one, it is certainly not for the lack of good testimonials.

The stems are not very abundant when compared with the leaves, hence the plant is more suitable for pasture than for meadow.

The following from Alexander Hyde of Massachusetts, is excellent and to the purpose: "We have found it one of the most luxuriant and nutritious, both for grazing and for hay. It never says die. It is the first to furnish a bite for the cattle in spring, is little affected by the droughts of July and August, and continues growing until the severe cold of November locks up the sources of nourishment. When cut or grazed it starts up with the vigor of the fabled hydra. We advise no man to sow it on his lawn, for it would need cutting every day before breakfast. If cut while in blossom, both cattle and horses are exceedingly fond of the hay, and do well on it. If left to stand until the seeds are matured, it becomes more tough and woody than even timothy, and cattle will need to have their teeth sharpened to eat it in this stage of its growth.

"Orchard grass loves a deep, rich, moist soil, and in such a soil no other grass yields such an abundant harvest. Why it is so much neglected among us we cannot divine, unless it is the fashion of sowing timothy and clover, and fashion is as much a tyrant among farmers as among the ladies, though showing his power in a different mode."

A. W. Cheever, a most successful farmer and editor of Massachusetts, writes: "I have now cultivated this grass some ten or twelve years, and feel that I can speak of it understandingly. It is a grass that must be understood to be appreciated. Grown on poor, dry land, by a poor, lazy farmer, who is always behindhand with his work, it will not give satisfaction; but on rich, moist land, capable of cutting two or three crops in a season, sown thickly with a mixture of clover and June grass, or other kinds ripening at or about the same time, and under the management of a wide-awake farmer, I can confidently pronounce it the most valuable grass known in this country at the present time. It may be cut two or three times a year, producing large crops of the very best of fodder, just as long as the fertility of the land can be maintained by top dressing. It is the earliest grass in the spring and the latest in the fall."

E. H. Libby, in 1883, wrote me that "a little while ago the New England Homestead contained namerous letters from farmers week after week, speaking in the highest terms of this grass."

T. D. Curtis, of New York, says: "Orchard grass is a most excellent hay plant, but it requires a rich soil. A well-sodded pasture of this grass is a thing to admire as well as for use and profit."

Wm. Crozier, of New York, speaks as follows:

"Heretofore the base grass in the Northern States has been timothy; but experiments that have been carried on for a period of twenty years have led me to believe that orchard grass is much better fitted to be the leading kind in mixtures, whether for pasture or for hay, or used alone or otherwise; and I place it far in advance not only of timothy, but of any other grass we have thus far in cultivation. It is very early. The advantage of this earliness is not only that it gives three weeks longer for the aftermath to grow, but another reason, far more important, is, that at this date the white ox-eye daisy and other troublesome weeds are not yet in a condition to seed, so that should any of them happen to be in the fields, they are destroyed by being cut before they have ripened their seeds."

L. F. Allen, of Buffalo, N. Y., approves of a favorable article in the New York Tribune, saying: "I have had it in continuous mowing and pasturage for upwards of forty years without disturbing it. As a market hay, I admit that timothy is more salable, because town's people do net know the value of the orchard grass, which is just as good for any kind of animal."

In the Country Gentleman for 1883, the same man of wide experience and observation, remarks: "Why it is that farmers are so dull in the use of orchard grass, passes my comprehension, when, on a single trial of its virtues, mixed with red clover when sown, equal in proportion for a hay crop, it is better for any class of stock than timothy."

The following is from the pen of Major H. E. Alvord, of New York, and was written for the Rural New Yorker:

"Orchard grass is a variety which has no superior for pasture or hay, and it matures so early that the crop may be easily got out of the way before timothy or red top is fit to cut. But orchard grass must have a good strong soil, and can be made most profitable by keeping land thus seeded in sod for a series of years. If cut twice a year or three times, as is often possible, it must be liberally top-dressed. With the land previously in good condition and a well prepared seed-bed, orchard grass is very satisfactory grown by itself. For this purpose, I would sow it as soon as the land can be put in order in the spring, or in the latter part of August, using at least two bushels of seed to the acre, put on with the greatest care, as it is a difficult material to handle, In 1884, orchard grass was in bloom in May, at Houghton farm, and good hay was made the first week in June. The period of cutting, as to maturity of plant, should be regulated according to the use to be made of the hay. It can be cut so as to make hay as fine as any rowen or coarser than any heavy timothy. If a mixture is desired for hay, tall meadow oat-grass and clover are the best for maturing with the orchard grass. Although orchard grass is hardy, furnishes the first green bite in the spring, and the last in the fall, and usually provides good protection with its own aftermath, it will winter-kill where not well-covered with snow, if the land is moist. It prefers a location rather high and dry, naturally or artificially well drained."

As a rule it blossoms but once a year, and then about a month ahead of timothy and red top.

It is often mentioned as very suitable for growing in the shade, but June grass does as well, comparatively.

Many cut it too late, when the hay will be of poor quality.

A farmer should not have too much of it for meadow, because it all comes on at once, and then it should be cut; the weather often controls the time of cutting. If rainy when the grass is in flower we must wait often a week or more. In such cases most grasses endure the delay better than orchard grass.

Some object to its use as the seed costs too much, from one to two dollars a bushel, making the seed for an acre cost from two to five dollars. Others sow on stiff, poor soil, where it makes a feeble growth.

TALL OAT GRASS (ARRHENATHERUM AVENACEUM).

Lieutenant Governor Sessions, of Ionia, has given this grass a good trial and reports: "In a very dry season the newly seeded clover and timothy disappeared, but the oat grass sown with it grew well. It more than holds its own with clover and timothy. It is rank and early and will seed twice each season. It makes good pasture and good hay and is very prolific. I want a permanent grass, so I have not tried to destroy it."

The speaker has raised this grass on rather light sandy soil at Lansing, Michigan, for twelve years or more, has seen it in some other localities in the State, and thinks he can tell why there are such conflicting opinions in relation to its value. In England the climate is moist, and the finer succulent grasses thrive well, while tall oat grass does better in a hotter, dryer climate. He has had occasion to kill several plats and has had no more trouble with it than in killing so much timothy. There are some bulbs on the sort raised in Michigan, but they are not hard to kill. Like orchard grass it ripens very quickly after blooming, and to make good hay there must be no delay in cutting. As it blossoms rather early, many let it go too long before cutting, when the stems become woody and of poor quality. Again, bad weather often interferes with the cutting just at the right time, and poor hay is the result. A man doesn't want a very large quantity of this grass to mow, unless he is prepared to cut it all in a day or two. It makes a fine growth the first season after sowing, and if sown alone will cut a good crop of hay.

I find that stock eat the grass well, though most likely they would prefer to have some grass not so bitter for a part of the time. The seed is rather light, weighing fourteen pounds to the bushel in the chaff. About two bushels to the acre are usually sown. Only half of the flowers set seed, as every other one is staminate. The seed is rather large, starts early, and soon makes a vigorous plant. This fits it for alternate husbandry and for dry countries.

In saving the seed, care needs to be used to cut the grass just as soon as the top of the panicle is ready. Not a half day should go by or seed will be lost. It is cut high, bound in small bundles, shocked till well cured, when it is drawn to the threshing floor on a wagon supplied with a canvass to save the shelling seeds. It yields from ten to twenty bushels of seed to the acre.

TALL MEADOW FESCUE (FESTUCA ELATIOR).

This is a very variable perennial, two to four or even five feet in height, generally growing in tufts or bunches, which from year to year creep slowly upward, as the new growth springs from the side of the old culms, a little above that of the previous year.

The roots are stout and woody, with a slight tendency to sucker, The leaves are rather firm, flat, varying much in length and breadth, but often one to two feet long.

The nodding, spreading panicle somewhat resembles that of a slender top of chess, with which every farmer is familiar. It flowers about a week or ten days before timothy.

Tall fescue has long been in high favor with the best farmers of Great Britain, as it is well liked by all domestic herbivorous animals.

Mr. Gorrie, a competent British authority, speaks of it as the most important species of the fescues, highly valuable for permanent grass lands, both for spring and autumn, but not the best suited for alternate husbandry, as it does not attain to full productive powers till the third year from sowing. It is very nutritious, making excellent hay as well as pasture.

This grass is seldom sown in a pure state, but is frequently met with, in the Northern States especially, where the soil is heavy and inclined to be moist. It seeds freely and the seeds germinate quickly and make strong young plants. If used alone, sow two bushels to the acre.

June grass, or Kentucky blue grass (*Poa pratensis*), is too well known to need an extended description. The same may be said of red-top, a favorite grass for bottom lands. Meadow fox-tail, fowl meadow grass and blue-joint are well worth trying. It must be borne in mind that, for the best results in pasture or meadow, no one sort sown alone will give so good returns as two, three or more sown on the same ground. Seeds of the common sorts of grasses are not difficult to get; but of others the seeds are often poor and much adulterated. Unless you know what you are getting, the only safe way is to have the seeds examined, before purchasing, by an expert.

DRAINAGE.

The advantages of drainage are many, even for growing grass, though it is probably true that grass land does not require to be drained as thoroughly as that which is arable. Drainage prevents damage from flooding for long periods when not desired. It is a protection against drought; it enables the grasses to start earlier in spring and grow later in autumn; it deepens the soil and prevents baking in dry weather; it allows the plant to receive greater benefit from fertilizers applied to the soil; it allows air to penetrate the soil; it prevents frost from heaving out the plants; it makes hauling of loads easier, and renders the land less liable to injury from the treading of cattle; it improves the better grasses, which thereby encroach on those of less value, including many sedges, rushes and useless weeds. Much of our grass land, especially that in permanent pasture and meadow, would be vastly improved by thorough drainage.

If water, in a wet season, stand nearer than two feet of the surface in a small hole dug in the ground, the land needs draining.

Fifty-five correspondents, in a recent report in England, agree that it is certainly unadvisable to break up any tolerably good pastures for the purpose of converting them into arable land. In 1881, nearly half the land occupied for agricultural purposes in Great Britain was in permanent pasture and meadow, and the proportion is on the increase. The proportion is greatest where the air contains most moisture. The late George Geddes, of New York, in 1882, reported a discussion of the Onondaga Farmers' Club. Men who had moist lands, with water under them, believed in permanent pasture. Men who cultivated dry soils, well adapted to a rotation of crops, easily plowed, and especially subject to severe droughts, were very decided in the opinion that permanent pastures are of little value as compared with grain crops, and hay and pasture in rotation. Rocky land and steep hillsides are best kept in grass.

The amount of rainfall has very much to do with the sorts of grass to be used and their treatment.

In Holland an acre of permanent pasture is said to carry one cow and a sheep. In Herkimer county, New York, rich permanent pastures carry one cow to each acre and a half, while in much of New England, Professor Stockbridge says, "Eight acres are required for one cow, and then she comes home at night looking disappointed."

Secretary W. I Chamberlain, of Ohio, in the Country Gentleman, says: "Our pastures are not so productive as we suppose. A fine old pasture of three years' standing, when mowed in a good season, yielded less than a ton to the acre, and in one season less than half a ton per acre. The grass was short June grass, red-top, red clover, white clover, and some timothy. The land is capable of better things. Next to it is a field, no better land, from which I have twice within ten years taken over three tons per acre of cured hay. Not even tile draining and top dressing will restore such old pastures and meadows. A rich ten-acre field of good, newly seeded pasture will 'carry' more cows than forty acres of old pasture."

The seeding down to good, permanent pasture, even under the most favorable conditions, is a slow and costly process. As we must infer, the climate and situation have much to do in helping solve the question whether to keep land permanently in grass, or whether to include the grass in a rotation of crops.

At the present day, even in England, some of the most advanced farmers favor breaking up the dryer arable land, and believe in this way they can obtain the largest yield of animal food.

In favorable climates, land which will permanently support a good growth of grass must be naturally of the very best quality, in good heart, well prepared, and afterwards liberally manured for some years.

There are a few excellent farms in Southern Michigan, in Ohio, Kentucky, Wisconsin, and neighboring States, which contain permanent pasture of good quality, and which yield liberally. Generally the grass does not continue uniform. It dies out or becomes thin in some places, and vacancies are filled with grasses of poorer quality, or with weeds of no value.

In Johnson's Agricultural Chemistry we read: "It is pretty generally acknowledged that land laid down to grasses for one, two, three, or more years is in some degree rested or recruited, and that it diminishes in value again after two, three, or five years, more or less, unless some manure be given to them. The opinion is due largely to the annual production of roots (and rootstocks) on old grass land, which is equal to one-third or one-fourth of the weight of hay carried off."

The roots of grasses extend deeper than is generally supposed. These with the stubble, old leaves, and turf, make a large amount of vegetable matter. Mr. Lawes estimates that on a good pasture they will weigh from five to ten tons per acre of dry matter, containing accumulated nitrogen to the extent of one ton.

In rather dry climates, where the rootstocks and roots of an old pasture have formed a mat of vegetable materials, the yield may be much increased by plowing and harrowing the land and let the grass again occupy the soil. This plan is especially well adapted to renewing the yield of June grass, quack grass, Bermuda grass, and Johnson grass.

In reference to permanent grass lands, J. Julie, of England, in his "Gold Medal" essay, makes the following remarks in Jour. Roy. Ag. Soc. for 1882: "The cultivation of roots and cereals deprives the soil of nitrogen, whilst that of grass and leguminous plants, temporary or permanent, on the contrary causes it to accumulate in the soil. That nitrogen being the most expensive to buy, it is not economical to devote part of the land absolutely to arable and part to grass, for whilst the one uses up the nitrogen, the other accumulates it in excess. It is preferable to alternate on the same piece of land the cultivation of roots and cereals with that of grass lays. By this means cultivation can be kept up indefinitely without purchasing nitrogen, provided the land be maintained in a fit state of richness as regards the mineral elements. The occupation of land by a grass for two or three years which takes its turn in the rotation of crops is preferred to permanent occupation by grass."

The late J. J. Mechi, of England, objects to old pastures in countries which are rather dry. The crop is too light; arable land is more profitable.

THE ADVANTAGES OF A ROTATION OF CROPS.

Some of them are as follows: Manure is economized, as crops do not all feed alike; the fertility of the soil is better and more economically preserved; weeds are more easily controlled; it enables a person to distribute his labor more evenly through the year; it gives a proportion of grain for feed and coarse straw for litter; crops in alternation are less liable to the attacks of fungi and insects. Where fields are occasionally cultivated, moles are less likely to become troublesome. Leguminous plants are not *specially* benefited by nitrogenous manures, but they are nitrogen "producers," and leave the land in fine condition for the grasses proper, including the cereals.

It would be better for the farmer if he looked more upon grass as a leading crop in his rotation, instead of one of minor importance.

PASTURE YIELDS MORE NOURISHMENT THAN MEADOWS.

The following experiment is reported by C. L. F. DeLaune in Jour. Roy. Ag. Soc., 1882: "After the grasses and clovers had grown one year and had become well established, one plat was mowed twice, and a similar plat was mowed six times during the year. The latter was to imitate the frequent cropping of grass by cattle.

Green, cut twice, total tons per acre	17.06
Dried, " " " "	4.49
Green, " six times, " "	21.26
Dried, " " " "	3.602

"The following shows the amount per acre of the most valuable substances contained in the hay:

	Nitrogen.	Phosphoric Acid.	Lime.	Magnesia.	Potash.
Cut twice	229.24	82.05	208.72	41.95	279.18
Cut six times	236.36	90.06	121.30	37.43	280.96
Difference	+7.11	+8.01	—87.42	—4.49	+1.78

"We see that, from the second piece cut six times, deficiency in weight is made up for by superior quality. It contains 7.12 lbs. of nitrogen, 8.01 lbs. of phosphoric acid, and 1.78 lbs. of potash more than the first crop. It is lower in percentage of lime and magnesia, which, however, are but of secondary importance for feeding purposes. It is certain then that cattle grazed on the crop of the piece cut six times would have been better nourished than those to which the hay from the first piece would have been given.

"Land used for pasture yields more nourishment than that where the grass is mowed off. Young shoots are much more nitrogenous than plants in flower and young green plants are more digestible than dried ones. In pastures the droppings of animals enrich the soil."

"Aftermaths are richer in nitrogen than first cuts, and they are more nitrogenous the younger they are gathered; they are richer, also, in phosphoric acid and potash. Theoretically, aftermaths constitute a better food than first cuts, yet they sell at a lower price, probably owing to their appearance, and because when dried they are more indigestible."

In considering the above experiment in reference to the great value of grass cropped often, we should not forget to take into account that cattle and sheep, while they roam over and over the field for pasture, injure the grass more or less with their feet.

WHAT MANURES TO APPLY.

This is a very puzzling question—one difficult to answer. In most cases no one can tell what would be best till experiments are made, but an intelligent person of experience can usually tell approximately what is for the best.

The substances most generally needed in manures for increasing a crop are those containing available nitrogen, potash and phosphoric acid. The influence of the weather, the moisture on grasses and clovers is much more marked than that caused by the richness or barrenness of the soil.

"The tendency of modern practice in manuring is to use readily soluble and quick acting manures, but to use them sparingly at each time. Little and often is the rule. It is not good policy to bury any manure very deeply, but apply it on or near the surface."—[Crops of the Farm.]

It is better to apply nitrogenous manures in spring when plants are beginning to grow. In what follows the reader will learn from the experience of others who have made many experiments with various kinds of fertilizers applied to grass land. For these we are compelled to cross the Atlantic, as but few reliable results have been published in America.

Here are two mixtures in which the requirements of potash and phosphoric acid greatly differ. The tables are from Mr. Julie:

First Mixture.

	Phosphoric Acid in 1,000 lbs.	Potash in 1,000 lbs.
Lolium perenne (Perennial rye-grass)	6.75	36.3
Phalaris bleuatre (Canary grass)	5.68	31.4
Avena flavescens (Yellow oat-grass)	5.98	26.55
Anthoxauthum odoratum (Sweet vernal grass)	6.85	25.89
Festuca pratensis (Meadow fescue)	5.52	21.83
Bromus Schraderii (Schrader's bromus)	8.07	21.55
Mean or average	6.375	27.256

Second Mixture.

Poa nemoralis (Wood meadow grass)	4.12	10.85
Bromus pratensis (A chess)	3.62	13.59
Poa pratensis (June grass)	4.43	15.24
Cynosurus cristatus (Crested dog's-tail)	3.72	15.24
Festuca rubra (Red fescue)	3.34	16.37
Phleum pratense (Timothy)	4.13	16.61
Mean or average	3.893	14.65

It will be seen that the average of the second mixture is only about half as exhaustive to the soil as the first in producing the same amount of hay.

Joseph Harris of Rochester, New York, says: "The cheapest and best manure to apply to a permanent pasture is rich, well-decomposed farm-yard or stable manure, and if it is not rich apply 200 lbs. of nitrate of soda per acre in addition."

After many experiments for ten or fifteen years, Sir J. B. Lawes concludes: "We learn from these results that good pasture grasses can never thrive upon a poor soil; and, if a soil does not contain in itself the elements of fertility, they must be added from external sources. I may add that, if the pasture of a rich soil deteriorates from bad treatment, the good grasses do not die out, but only retire from the contest to wait for better times. Under invigorating treatment, it will be found that the good grasses soon reässert their supremacy."

Green manuring is well worth some attention. For this purpose, the leguminous crops are very desirable, as they draw a very large per cent of their food from the atmosphere. I will name common red clover, mammoth clover, alsike clover, melilot or sweet clover and perhaps some sorts of cow peas, vetches, peas, etc.

In estimating the value of the manure made by animals, only the nitrogenous and ash contituents of the food are considered, as the carbonaceous elements are supplied by the atmosphere. Over 95 per cent of the nitrogen and ash constituents are voided in the excrement in the cases of sheep and oxen. This shows a very small waste of the fertilizing matter of food in fattening sheep. If 90 to 95 per cent of these fertilizing constituents of food could be actually saved by farmers and returned to the soil, then it is easy to see the effect that must be produced by judicious stock-feeding upon the depleted soils of the New England and Middle States. The farmer should also remember that considerably more than half of the fertilizing of manure is to be found in the urine, and this is much the more valuable, according to the quantity, as it is all soluble and becomes immediate and active plant food.

MANURE AND DRAINAGE IMPROVE THE QUALITY OF GRASSES.

We have nothing better to offer in this connection than the results of some excellent experiments by Dr. A. Voelcker, recorded in Jour. Roy. Ag. Soc., p. 377, 1866:

"A comparision of the composition of the improved hay with that from the unimproved pastures offers several points of interest.

"The proportion of woody fiber in the good hay is much reduced.

"The amount of flesh forming material is considerably increased.

"The total amount of albuminous compounds is increased one-fourth.

"The difference in the proportion of sugar and other soluble matters is very marked, the bad hay containing only 10 per cent, the good hay nearly 15 per cent of sugar.

"The proportion or fatty or waxy constituents likewise is larger.

"The increase in the soluble mineral matter shows that the good hay is the more succulent."

Here we see, then, that arable land produces grasses of better quality than marsh land, that rich land produces richer grasses than poor land, and every farmer knows that grass grown in the open meadow is more nutritious than that grown in the shade of trees, that the short growth in a dry season is more valuable per ton than the rank growth in a wet season.

EFFECTS OF IRRIGATION.

The speaker has had very little experience in irrigation, but briefly gives the opinions and results of some experimenters, hoping thereby to set farmers to thinking, observing, reading and experimenting on this interesting subject. To conduct irrigation properly is quite an art, but it has often been well done with surprising results, converting a lean, hungry meadow into an oasis. Sinclair, in his famous old work on grasses, says: "Irrigation is the easiest, cheapest and most certain mode of improving poor land, in particular if it is of a dry and gravelly nature. The land is thus put into a state of perpetual fertility, without any occasion for manures."

To the farmers of Connecticut, J. S. Gould said: "You should sow many different varieties of grasses, and by the aid of irrigation you would have seven or eight times the amount of grass you now do." To the same people, Solon Robinson said he had no doubt that if the streams of Connecticut were properly utilized in irrigating the soil, they would be more productive in value than by turning all the water-wheels of the State.

After experimenting on this subject, Mr. Pusey, in Jour. Roy. Ag. Soc. for 1849, said that the money spent in irrigating grass land yielded a profit of 30 per cent. "All water is a weak liquid manure—the warmer the water the better. A slight film of water trickling over the surface—for it must not stagnate—rouses the sleeping grass, tinges it with living green, and brings forth a luxuriant crop in early spring, just when it is most wanted, while the other meadows are still bare and brown. A water meadow is the triumph of agricultural art. The best irrigated meadows are those upon a gravelly soil, with a good drainage."

Take the results in a poor meadow in England, irrigated in an inferior manner. The field trebled in value in four years. The table shows us that all the better grasses have increased, if we except the *poa trivialis* and *Hordeum pratense,* in which cases there has been an increase in grasses not possessing the best character. Innutritious herbs in pastures are destroyed by irrigation, and their places are supplied by the better grasses. Parsley and narrow docks are exceptions and are increased by irrigation. In other words, we conclude that the best grasses are a sign of good land or good treatment, by manuring or draining or irrigation. They are the most sensitive to good or bad treatment. They are hearty feeders and are the most exhaustive to the soil. Sedges, rushes, mosses, the ox-eyed daisy and most other weeds point to land that is out of order.

[In this connection, the following, taken from the proceedings of the eighth annual meeting of the Society for the Promotion of Agricultural Science, held at New York City, will be of interest. —EDITOR.]

SOME SUGGESTIONS AS TO EXPERIMENTING WITH GRASSES.

BY W. J. BEAL.

As "grass is king among the crops of the earth, and the foundation of all agriculture," the family deserves closer study by the husbandman. The former neglect of the grasses, owing to the great difficulties of learning to distinguish them, leaves a field of great promise, ready for those who are willing to study and experiment, patiently, for many years to come.

1. It will be folly to attempt very many experiments with grasses without they are under the eye of a good agrostologist.

2. Try as many species as possible from every known quarter of the earth, planting in rows three inches apart. Make the plats one by ten rods after they seem to promise usefulness.

3. Scatter the plats as much as possible, allowing none to come next to each other on account of the liability to become mixed by the scattering of seed.

4. Sow certain combinations of species which thrive well in any place, to compare with each sown by itself.

5. Sow some combinations of grasses which produce no rootstocks.

6. Sow or plant certain grasses, mixed, the species all producing rootstocks.

7. On a variety of soils, in several parts of the country, sow in rows three inches apart, and weed out all excepting grasses, seeds of a large number of species mixed together. Grow these for years, noting the changes that take place.

8. Analyze several species of grasses of the same age and species grown on similar soils: in one case the grasses to be much crowded, in the other, each plant to have an abundance of room.

9. Try to improve grasses by culture and selection, and changing seed. Try some on rich land, with good care, and plenty of room, and compare with the same species neglected on poor soils and crowded. Select seeds of both lots and sow for comparison.

10. Select ground for stations, say in Michigan, Nebraska, Texas and Arizona.

I think the time could be very profitably occupied by hearing from those who have had experience with these lands. I talked with some men here this evening and with some coming here on the train and I know some of them have ideas that are valuable on these topics.

Dr. R. C. Kedzie: I would like to ask the opinion of Prof. Beal in respect to the wild grasses that are grown here, bunch grass, blue joint and various other grasses which I have gathered here on these plains, that come up here at the close of the season's crop.

Mr. Beal. Finger grass or blue joint, an andropogon, is not generally esteemed, but in some parts of the world is considered to be one of the best grasses; in Kansas, Nebraska and on the plains of the west they consider it very good indeed. They cut it and make extensive quantities of hay out of it. There is a blue joint grass that grows in wet places which seems to me one of the best grasses for this part of the country, especially on land that is a little low. It is a grass that grows pretty high, with a top something like red top. It is one of the grasses mentioned in the list for marshes. The other grasses referred to by Dr. Kedzie won't stand close pasturing.

Mr. Willits: I notice alsike clover in the same list of grasses. I would like to know if it would answer in this climate.

Mr. Beal: It is called Swedish clover, and comes from a cold climate where the soil is no better apparently than here, and I see no reason why it should not be a good grass to raise here.

Mr. Willits: Would it do in these sandy, yellow plains; would it grow?

Mr. Beal: I never was here before, but I should think so; I should think it was well worth trying, that is all I can say. I would not try these things in a large way, but I would get a little seed and try it in a small way; but without any experiment you can see that no one can tell just what is best to do. For hay, farmers are generally disappointed in it, as it is very apt to lodge.

Mr. Fauble: I have tried it in a small way. It grows very strong and vigorous; the roots grow very deep in the ground and are large, but the stems are slender and it is apt to lodge and rot in consequence.

Mr. Beal: Lives over winter pretty well?

Mr. Fauble: Well, yes. I have just tried it on a small scale.

Dr. Manly Miles: Alsike is very uncertain as to succeeding in any particular locality where it has not been tried. I find some persons who are very much pleased with it and say they have got a good crop; but I have tried it many times and never got a good crop, and should judge that for this locality the common red clover was better.

Mr. Willits: Can somebody tell us what white clover will do?

Mr. Groves: I have sowed it with orchard grass right here by our village; it remained in two winters and lived as well as the orchard grass did, and orchard grass is one of our best kinds.

Mr. Rose: I would like to have the professor discuss the merits of Alfalfa for our country?

Mr. Beal: It is not a promising kind where other clovers will grow. It is a child of the sun, doing the best in hot countries. We have tried it at the Agricultural College and it does pretty well where the soil is deep and porous. It is especially adapted to dry regions. It is not worth trying on land you intend to plow up in two or three years, as it takes some years to get established; but if it is put in with care, and not pastured until it gets well established, it will stand for a number of years and stand well. It needs to be mowed two or three times a year or else the stems become woody. I would not recommend it for this country.

Mr. Willits: I would like to know the experience of the farmers as to whether there is any difficulty in keeping clover growing. As we have been turned out to grass, let's have a nibble at it.

Mr. Lound: If the ground is not entirely run down before the clover is put in, it will take hold and grow. June clover does well and mammoth clover does better and with a good sod, turned in, the soil will raise nice crops.

Dr. Beal: Early clover or what many farmers call medium red clover, is a biennial plant and therefore will not do much in one year, nor last well more than two years.

Oat grass and rye grass are not natives and do not grow wild here. The latter runs out in a short time on our lawns.

Tuesday A. M., February 1, 1887.

Mr. Steckert, being unable to be present, sent the following letter, which was read:

GRAIN RAISING ON THE PLAINS.

BY JACOB STECKERT, OF SOUTH BRANCH, CRAWFORD COUNTY.

I began farming in the township of South Branch in 1876, but did not raise any grain until 1880, when I sowed rye and oats, both following after potatoes.

The oats were White Norway, grown on soil which, when first broken, was about the poorest on the farm.

The field was well prepared and about twelve wagon loads per acre of barnyard manure put on it, and then sowed to the oats and seeded with one-third timothy and two-thirds clover. When ripe the oats stood four feet high and yielded 50 bushels per acre.

The rye field was on a side hill, somewhat stronger soil, and was prepared in the fall in the same manner, manured about as heavily, and seeded in the spring. When ripe the average height from the stubble was 6 feet 5 inches, and the yield 15 bushels per acre.

The first crop of hay following the oats yielded a ton and a half per acre and the year after gave good pasture.

The seeding with the rye was not a good catch, so I put on six good loads of manure per acre and sowed to wheat, seeding at the same time. The result was 22½ bushels of wheat per acre and a fine catch of clover and timothy which cut the following season almost two tons of hay per acre.

Two years after I broke up this same piece and put in wheat ; yield, 20 bushels per acre ; stubbled in wheat again; yield, 17 bushels per acre.

I also tried some barley on a rather sandy piece of land, applying 100 lbs. of phosphate per acre, drilled in with the Buckeye drill. The yield was 15 bushels per acre, with a remarkable stand of the mammoth clover, which cut two tons of hay per acre the next season.

For an experiment I sowed four acres of a new breaking on strong soil to wheat and got 14 bushels per acre.

I have raised millet several times, the average yield being from one and a half to two tons per acre.

My last year's crops were light on account of dry weather. The wheat, partly on sod and partly manured, gave but 14 bushels to the acre, and the oats were almost a failure, except for one very good piece on the river flats. The upland was, I think, too heavily manured, having on five acres 34 sleigh loads, equivalent to 100 wagon loads of green camp manure, and the land being sandy and not as strong as some of my lands, was more affected by the dry weather. The after growth was heavier than the crop and I plowed it under and put in wheat and seeded, and the wheat looks very promising. Altogether I put in last fall 41½ acres of wheat, of which 40 acres are also seeded.

I have now 100 acres under the plow.

My tools consist of the following, in addition to small tools:

Three wagons, one Buckeye mower, one Chieftan hay rake, one Saginaw plow, one Diamond iron plow, one Buckeye reaper, one Buckeye drill, one Kalamazoo sulky harrow, and one Toledo plow.

Capital to start with, $450.00 and a family of nine. I might add that potatoes and the kitchen garden have also done very well.

Mr. Willits: I would like to have some farmer inform us whether Mr. Steckert's farm is a characteristic plains land farm; I don't mean the poorest, but an average as the plains land runs,—whether there is any quality in his soil that is better.

Mr. Palmer: I would ask Mr. Hubbard Head to answer President Willits. He is intimately acquainted with the place and well acquainted with farms in all parts of the county.

Mr. Hubbard Head: I would say that the farm of Jacob Steckert is better than the plains will average. It is a gravel mixed with clay loam and sand. It is on a side hill, and the high land in Crawford county and surrounding it is better land than the plains,—the level lands. His farm will average better than the general low plains land.

Mr. Webber: What was the timber originally on the land?

Mr. Hubbard Head: Jack pine.

Mr. Webber: No hardwood?

Mr. Hubbard Head: No, sir. There is probably in the neighborhood of 10 acres river flats.

Mr. Willits: What is the difference between land on which jack pine grows, white pine land and hardwood land?

Mr. Frederick Barker: I think Mr. Hubbard Head is mistaken about the character of the timber on that land. I saw that land fifteen years ago, before there was any timber cut from it. In addition to the jack pine there was a good deal of scrub oak, some poplar, and in places considerable white birch. On some portion of it the timber was nearly all oak grubs and oak trees up to the size of twelve inches in diameter, they were rather short, not over thirty-five feet high. I was also there the first summer Mr. Steckert commenced his clearing and staid over night with him.

Mr. Hubbard Head: I helped Mr. Steckert do his first chopping on that farm. Along the river bottom there was some birch, cedar, white pine, considerable tamarack, and all that kind of timber, and on the uplands, on the ridge, there was some poplar that grew to be from one to six inches through, the majority of them being not over two inches through. The lightest land we find in Crawford county is where we find scrub oak. That appears to be lighter land than the jack pine land; there was not much of any hard wood, and but a very small portion of the land had poplar on it, most of it being jack pine land.

Mr. Willits: Will you please describe what jack pine is?

Mr. Hubbard Head: It is spruce pine; some call it pitch pine. I never saw any of the timber growing excepting in Virginia and here.

Mr. Willits: What does it indicate as far as soil is concerned? What is the difference between that and white pine land?

Mr. Hubbard Head: I could not say as to that. You will find it growing at very high altitudes and you will find it growing on very low lands.

Mr. Beal: There are three kinds of pine in Michigan, white pine, Norway pine and scrub pine, gray pine or Banksiana pine. In 1875, in collecting timber for the Centennial, I inquired of fifty or more persons around the country as to what they meant by jack pine; they generally meant this scrub pine. They apply the term jack pine to inferior looking pines of any sort. They also call it buckwheat pine, and perhaps, several other names.

Mr. Webber: Jack pine is the Pinus Banksiana.

Mr. Willits: I would like to know if this scrub pine indicates a light soil?

Mr. Webber: I never saw it growing except on a light soil. You will see some of it along the south end of Lake Michigan as you approach Chicago on the Michigan Central Railroad, growing on the light sandy soil near Michigan City.

Mr. Shriver: Jack pine grows on most any kind of land. I have some clay soil that is just as heavy as any land, and jack pine grows on it as thick as on any other land, and I have sand upon which it grows just the same.

Mr. Love: I cleared off fifteen acres of what you call jack pine lands, and some of it was pretty heavy, the soil being a solid heavy clay. In the neighborhood where I live there is not much jack pine growing on our lightest lands, in fact there is not much of anything that grows on them, but as you get on to higher ground you generally find the higher the land the better the soil. On my land the jack pine grows in clumps of no great extent. On the highest land, where there is a good solid gravelly clay loam, the growth is mostly oak grubs, filled in with witch hazel, thorn, poplar, June berry and any amount of willow.

Mr. Webber: What kind of oak are those grubs?

Mr. Love: Red oak and white oak. The stones are so thick on some of the land that it makes a man's elbows ache to look over it after the land has been cultivated. The stones range from as big as your fist up to boulders that will weigh tons. This jack pine was a native of my old Pennsylvania home, and there they call it pitch pine. There the soil was very light, lighter in fact than it is here, and yet by careful cultivation, seeding to clover and turning it in, it has made the best farming land in northwestern Pennsylvania.

Mr. Palmer: From the answers already given you will see that we have jack pine lands in this county of every gradation, from the lightest sand to heavy clay. On Mr. Thurber's place is a clay that will compare very favorably with Williams county, Ohio, lands, and on the same place there is soil of the lightest grade, and jack pine grows equally well on all of it.

Mr. Randall: I have been on these plains for the last five years. I am not well versed in botany, but am inclined to think that this is no pine at all, but a spruce, as the annuals are less than an inch long. The United States survey calls it spruce pine. It grows on clay as well as on sand, but always where there is little or no vegetable matter in the soil—always on poor land. Fires sweep over the plains and seem to burn everything of a combustible nature, and the spruce pine will come up and be burned down and come up again just as thick as wheat. Some think it grows on dry lands only, but it grows in what we call jack pine swamps, where there is water all under and around it the same as in soil that is very dry, with scarcely anything on top of the sand excepting the annuals that have been dropped from the pine.

Mr. Love: In regard to this jack pine growing on wet land. The north half of section thirty, the south half of the southwest quarter of section twenty and the northwest quarter of section twenty-nine, when I first saw it eleven years ago last August, was a bed of muck. At that time of the year it was dry for a few inches deep, but to-day, and for the past three years, that bed of muck has been covered all over with water. It was covered here and there with old jack pine stumps, six to ten inches in diameter. Around the border of it and encroaching upon the muck there were green jack pine, some six to ten inches through, Three or four years ago we found the water didn't disappear through the summer, but kept rising, and we built a road across the place, spending considerable money in building the grade through, and to-day that grade is under water at least three feet and a half deep. After the water came up there and remained permanently this green jack pine around the border began to die, showing that some time in the past this had been a pond of water before, that the water had come there and killed out the jack pine. There is something curious about the matter. It seems to be a periodical thing, but how long the period is I don't know. It shows that jack pine don't flourish well where its roots are in the water.

As to what soils produce the three varieties of pine, the white, the Norway and the scrub or jack pine. Along the Susquehanna in Pennsylvania where the jack pines grew, the soil was sandy mixed somewhat with gravel ; in this State we find them on all kinds of soil, as already stated ; in Crawford county the Norway or yellow pine grows on about the best lands we have, that is on the high lands, where the soil is gravel mixed with clay loam and sand, what you may call solid soil. Where the timber is exclusively white pine the soil is lighter and more sandy. This is my experience in the pine lands of Michigan, Pennsylvania and western New York.

Pres't. Willits: Let us get back to the question under discussion. Have you raised any wheat?

Mr. Love: Two years ago last summer and fall I cleared up fifteen acres, broke it up and sowed it to wheat. The conditions where quite unfavorable and my crop, after being threshed by a machine, yielded only seven bushels to the acre and I had a big, tall wheat stack too. The next season I broke ten acres of the fifteen, harrowed and cultivated and sowed right on the raw sod without any fertilizer. The Hessian fly troubled it somewhat and I threshed again in the same manner, with a machine that paid a mighty big toll to the ground upon which the machine stood and also to the straw stack and it yielded about eight bushels. Last fall (being the next season) I turned the sod back on the same ten acres and sowed to wheat again on September 12th, and when it went under the snow it made a fine appearance, covered the ground nicely and looked as though it might produce a much larger crop next year. As a rule I would prefer to sow a little later, on account of the Hessian fly. They injured the last year's crop a good deal.

Mr. O'Dell: I have been in Crawford county fourteen years the coming spring. I came up here for the purpose of farming. My land is plains and some of it had this large Norway timber and some white pine, some little hills had what we call jack pine on; there was not much jack pine on my place. I have tried to raise wheat on the pine plains. I never could get over twelve bushels to an acre. I cleared a piece a year ago last summer of twenty acres, stump land; it was Norway with once in a while a white pine and once in a while one of these yellow jack pine, as we call them, that grew to be twelve or fifteen inches through. I cleared the land, broke it up and sowed it to wheat the same year without any fertilizer. This last summer I threshed about two hundred bushels from the twenty acres. I cleared off an acre six years ago and put it into potatoes; the potatoes didn't come up. I broke it up in the fall and sowed it to wheat. I had eight men and boys picking up roots after the drag and made it look like a garden, no fertilizer on it, and I took thirty bushels of wheat off from it. I sowed to clover and timothy right off that fall, after having plowed it and dragged it and picked up the roots again and made it as nice as I could; the next summer I got a ton and a half and the summer following two tons of clover and timothy hay. Then fire got into the fence around the field and the wind struck it into the clover and it burned about four rods back. I told the boys to plow it right up and we sowed it to wheat, but didn't get as good wheat there as we did in other places, the whole acre giving only ten bushels. After that I sowed it to Welcome oats, an extra kind that I have raised two years, but we didn't get five bushels from the whole piece and it was perfectly matted with sorrel, which came in after we sowed it to oats. Now I propose to plow up the ground and cultivate it to kill the sorrel. I considered it the best piece of land I had because it was covered with dead Norway timber and had some leaf mould in the soil.

Mr. J. G. Marsh: The fire is what made the pine plains originally in this country by burning out all the vegetable mould that was in the soil. Norway timber has a good mould in the soil, but on our jack pine plains there is no vegetable mould at all, or almost none. I have one hundred and sixty acres of land, of which perhaps fifty have some scattering Norway trees on but it isn't Norway timbered land; it is jack pine plains mixed with red oak grubs; there is some white oak timber six to ten inches through, and some soft maple. I have got a good farm out of it. I have raised wheat and fall crops. It has averaged all the way from six bushels to seventeen. A year ago last harvest I harvested eight acres of wheat; I put it in in pretty good shape and threshed it with a machine and my average was six bushels to the acre. The next year I sowed part of the same piece and enough more of the same kind of ground to make twelve acres and got an average of ten bushels per acre. Some of my land is heavier than jack pine land and some of it is sandy loam, not very sandy. The best average I have had was ten bushels, but I did get seventeen bushels once off a small piece of ground.

Mr. N. H. Evans: I have lived ten years on the plains. I have raised from ten to eighteen bushels to the acre. I raised it on new breaking and on second, third and fourth plowing. My best crop, eighteen bushels to the acre, I raised on four acres of new breaking. There was some clay in the soil. I find raising wheat on first plowing requires a good deal of labor, but I had as soon risk it for a crop as second, third or fourth plowing if it is thoroughly worked with a spring-tooth harrow.

Mr. Lounsberry: The general experience of my neighbors is that the first crop is the best.

Mr. J. G. Marsh: My experience has been if I break up ground in the spring and put it into wheat I am sure of a fair crop, and if I take that same ground and stubble it in, cross-plowing in the fall, I am as sure of a crop then as before, and the yield is apt to be better if the ground has been well prepared. Two years ago when my wheat went six bushels to the acre stubbled in three acres on the same ground and got ten.

Mr. N. H. Evans: I don't like spring or fall plowing or breaking. Plow in June or July when the brakes are all out green and in full leaf. Turn them under six or seven inches and work well and I will risk the ordinary plains for a crop of wheat.

Mr. Sewell: You can't plow in the fall of the year and make a success of it, I don't care in what country. It is my rule to plow when the grasses and everything are filled with moisture. I never want to plow over three or four inches deep. Plow in June and go over it again in September and it will be like ashes. If a man would offer to plow my ground in November for nothing I would not have it done; I should rather pay for it and have it done in June. (Applause.)

Mr. Love: I agree with the gentleman. Plow the last of June or the first of July when the grasses are full of juice. I would rather pay for having it done then than to have it done for nothing in the fall.

Mr. W. C. Johnson: Why is our wheat crop on the pine plains usually injured in the spring? Most of it looks well in the fall and goes under the snow looking well, but after that it seems to be tender.

Mr. William Metcalf: I have been farming on the plains here six years and have had reasonable success. I came to Michigan about 50 years ago and commenced farming near Ann Arbor on the white oak openings there; and am not so much discouraged with the barrenness of the plains as I would have been if I hadn't lived there. Around Ann Arbor, 50 years ago, we could not raise as good average crops as we can here on the plains. I remember when we got eight bushels of wheat to the acre there we thought it was a good crop. The ground was all light oak openings and the same woods and the same ferns that grow here flourished there. I have raised all kinds of grain and I have always exceeded the State average. I broke a piece of land in June and July, three years ago, for the first crop and sowed to wheat and it produced 16 bushels to the acre. It was turned over next year and planted to corn; it brought an average of about 60 bushels of ears to the acre. I planted an acre of it last year to potatoes and that produced 200 bushels. My average of wheat all through on new breaking is seldom much less than 15 bushels to an acre. As far as the lands deteriorating and growing poorer it is not so in my experience. My land grows better and the crops grow better; the longer I farm it the better my crops are. I had splendid grain last year, good wheat, good oats, good crops as anybody anywhere in the State of Michigan. I live three miles east of Cheney, in Center Plains township. The soil is better than the average plains; it was originally timbered, I think, with Norway; there is some jack pine on it but not much, and what jack pine was on it was large, no small jack pine but good large timber; that is all I ever saw. I never saw any grow to exceed 12 or 15 inches. There is clay on the surface in spots, but such spots do not seem to be any more productive than the sand; in fact, for the first crop, not as good; though they may be a little better after a few years.

Dr. Miles: How is the sub-soil?

Mr. Metcalf: Nearly all of it has a clay sub-soil down to the depth of sixteen or eighteen inches and where there is no clay there is a kind of hard pan, or some soil harder than clay; you can hardly dig it or do anything with it, it appears to be welded together so you can hardly get through it.

Mr. Willits: Is that a characteristic of the plains lands generally?

Mr. Metcalf: I think not. The most of the plains land has very little hard soil under it. On the high lands this sub-soil predominates and they are the best lands that we have. I think that I have got the best land in the country.

Mr. Reynolds: Are your high lands jack pine lands, generally?

Mr. Metcalf: No, the timber is Norway, mixed with white pine—big white pine.

Mr. Head: I have a genuine plains farm. I think it is the poorest in Crawford county. There isn't a thing on it but sand and there isn't a thing under it but sand for seventy feet. I plowed up a cow yard of half an acre and planted it to corn, followed the corn with wheat sowed Sept. 14th, and from the half acre got eighteen bushels of wheat. I had, besides, three acres and a half of wheat following potatoes, they having been the first crop ever grown on the land. The wheat was manured somewhat and yielded twenty bushels per acre.

Dr. Miles: The scrub oak has been spoken of to-day as a red oak. That is not quite correct, as the red oak is a large tree. The proper name of the scrub oak is, I think, scarlet oak.

Dr. Beal: I agree with you that what is here called scrub oak is the scarlet oak.

Mr. Johnson: I think I have the poorest land in the county, poorer than Mr. Head's. I bear him out in his statement that jack pine lands are poor lands. My land is entirely jack pine land, and the jack pine is pretty poor at that, it don't grow very large. My first crop was poorest, my second crop was better than the first (I think it was a better season) and my third crop was poor. I have not cropped it since to see whether it would be better; didn't think there was any use. I thought perhaps I had got all there was in it and left it there. It would catch the grass even then.

Mr. Webber: Will these gentlemen please state whether they refer to winter or spring wheat.

Mr. Love: Mine was winter wheat.

Mr. J. G. Marsh: I meant to have said my wheat was winter wheat.

Regarding the depth of soil here on the plains, it is from forty to eighty feet to water.

Mr. Thomas Lound then presented the following paper:

ROOT CROPS IN CRAWFORD COUNTY.

The idea seems to have gone abroad that the plains lands of Northern Michigan are a barren waste of sand susceptible of raising nothing but snow storms and pine logs in winter, and drifing sands interspersed with mosquitos and flies in summer, with an occasional deer or bear thrown in. The specimens of our products exhibited here to-night prove these ideas to be erroneous.

While we are all willing to admit that we are subject to the drawbacks incident to a new country, yet these are no greater here than elsewhere. To further prove this claim I will give you an experience of eight years in raising roots on the plains of Crawford county.

I understand the term root crops to include potatoes, beets, carrots, rutabagas and turnips.

Commencing with potatoes. In the spring of '78 on new breaking I plowed the first part of May and planted during the same month in rows to cultivate. After plowing, the ground was thoroughly dragged and prepared as if it had been old ground. The crop was cultivated during the growing season. This way of planting and cultivating did not suit my ideas. The seed was not deep enough and the potatoes were more inclined to grow small ones up on the vine than large ones down in the ground, and I think that cultivating after rains increased this tendency. My crop was about 35 or 40 bushels to the acre.

In the spring of '80 we tried plowing them under on new ground, that is, we dropped the seed in every third furrow, about two feet apart, after plowing, giving a thorough dragging and no other cultivation. The result was a little over fifty bushels to the acre. This finished my plowing under potatoes on new ground. Those planted the same season on second plowing without any manure whatever, three feet apart each way, and cultivated both ways, yielded on half an acre 38 bushels of good marketable potatoes.

In the spring of '81 I tried the plan of planting what ground there was manure to cover, taking a piece of ground that had been cropped twice without any manure, and sown to winter rye the preceding autumn to make what growth it would to plow under. I spread four wagon boxfuls of fine manure on about one-quarter acre. Three-eighths of an acre I fertilized with homestead phosphate, and one-eighth had no manure whatever, making in all three-quarters of an acre. This I planted by plowing the potatoes under in every third furrow, and cultivated one way, but did not hoe. The result was sixty bushels of very nice potatoes, those manured and phosphated being about equal, while those without manure were about one-half as productive as the others, actual measure, row for row.

In the spring of '82, having five acres of timothy sod to plant corn on, I tried one-half acre with potatoes, plowing them under, but the experiment proved almost a failure, as the sod seemed to smother the seed, so that they rotted in the ground, and what did grow were not half as good as some planted on corn stubble, but I felt so well satisfied with the result that the next spring we planted two acres of the aforesaid timothy sod after corn, the net result being four barrels of very small potatoes. The trouble was that most of the seed failed to grow, and what few did grow looked very disconsolate.

In the spring of '84 we planted one acre on second plowing, three by five feet apart, the same as corn. The crop promised well until the last of August, when the frost killed the tops and hurt the crop fully one-third, but we got fifty odd bushels of good, sizeable ones, besides the small ones.

In '85 we planted two-thirds of an acre that had been cropped for seven years, and one-fourth acre that was timothy sod the summer before, plowed under after the hay was mowed, and then sown to rye and this rye plowed under. The whole eleven-twelfths acre was manured before plowing for the potatoes. The potatoes were planted the first week in June, three by three each way, and cultivated both ways, but not hoed. From this we dug one hundred and eighteen bushels.

In '86 I manured one-half acre of buckwheat stubble, the buckwheat having followed timothy hay and been mixed with rye, which was still green when plowed under for the potatoes. We planted the first week in June, three by three feet and cultivated same as previous year. The cut-worms only left me about four hills out of five, and by that I got sixty-five bushels. I can raise the best potatoes the second plowing of sod ground, planting about as deep as plowed, cultivating after rain as often as possible until the vines get large enough to fall over, keeping the ground level and well stirred, and then it will stand about as much dry weather as any land that I know of.

(Perhaps it might be well to add that you should never cultivate with a gun or fish pole, as these are death to the potatoes and help the bugs.)

My standard crops of roots are carrots and rutabagas. Carrots I prefer sowing on ground manured the previous year, as the roots grow smoother and of a finer quality. I prepare my ground by plowing, and then smoothing it down level and hard, then sow in rows eighteen inches apart, using a Planet, Jr., seeder and cultivator, which I find a great labor-saving machine, and one which does the work much better than by hand.

My first crop was sown in the spring of 1880, on second plowing and manured the same spring. The seed was good and I think every seed grew, for, to use a common expression, they came up "thick as hair on a dog's back." I failed to thin them out as much as should have been done, consequently there were many small ones, but my cow had no objection to size if the quantity was only there.

On this piece there were twenty-seven rows, each seven rods long, from which I got thirty-three bushels, or about three hundred bushels to the acre.

In the spring of 1881 we sowed a piece of ground five rods long by two wide, this being the third crop, but it had been manured the year before. I was careful not to have them so thick in the row. The result was very fine specimens; net result thirty-two bushels, or at the rate of five hundred and twelve bushels to the acre.

Those two years are the only ones that I have measured ground and bushels, so as to be able to give a correct account, but I have raised carrots every year, and the longer I work at it the better I am satisfied with the result.

The White Belgian is my favorite variety for field culture.

Rutabagas I like to sow in drills three feet apart, but I have the best success planting them in hills three feet apart and cultivating with horse each way. I thin them out to two or three in the hill and have the ground manured the year before. I had specimens this year grown in this way weighing twelve pounds and very fine grained.

White turnips I do not consider of value as a forage crop, although they are productive. I had some specimens this year that would measure ten inches in diameter and have seen larger than that grown on the plains.

Mr. Metcalf: I have some lots in the village of Cheney which I use for potatoes, roots and all sorts of garden produce, and as to raising roots I think we can beat Ingham county, where I came from. I raised some radishes as big around as my thigh, but they were hollow. I think this ground will raise most anything that you can put in if it is well taken care of; but the fact is, we don't farm it faithfully. If they should farm in Ingham county as we do here they could not live on it. They have not the lumber business there. A man comes here poor, and to make a living he goes to the woods with his ax and saw, and consequently neglects his farm, and he can't raise crops without labor. I have raised 100 bushels of potatoes on an acre of ground in rows one way, one foot apart in the row. The soil needs a little nursing at first and pays for manuring.

Mr. Niles: I set out strawberry plants last year in rows three feet apart and sowed between the rows rutabagas and had a nice crop. On four acres I sowed to flat turnips I had some 300 or 400 bushels. The present season I had two acres and a quarter in turnips which yielded about 500 bushels.

Mr. Van Buskirk: There has nothing been said as to the variety of potatoes best adapted to this soil. In our section of the country the Early Rose seem to be going back, they turn red in streaks inside, and I have abandoned them.

Mr. O'Dell: I have raised the Early Rose for ten years, and the Late Rose. The Late Rose has the red spots more than the Early Rose. I don't think it hurts the potatoes; I think it is a good potato. For the last two years I have raised the Beauty of Hebron. Last year I plowed up clover sod and planted it to potatoes and I don't think you ever saw nicer potatoes than I raised. The Beauty of Hebron is a better potato for the table than the Early Rose. I sow my turnip seed with my clover in June; I mix them and it don't cost me anything to raise my turnips, only what it costs me for raising my seed and pulling them. I sow it right in with the clover and I think it helps the clover too.

Mr. Rose: Being inexperienced in farming when I came here, I experimented with different kinds of potatoes and ways of putting them in. I do not think the Early Rose does as well as two or three other varieties. My first potatoes were the Late Rose that I got from Gaylord, from the hard wood country. I planted about June first. They were very fine, good sized but very few in a hill. The next season I planted the Early Rose, the Late Rose and the Mammoth Pearl. The Late Rose did very well, at the rate of 150 bushels to the acre, the Mammoth Pearl went a little over 300 bushels to the acre and a special test I made of the Mammoth Pearl went 450 bushels to an acre by measurement, with the finest kind of cultivating on second plowing. I perceive no difference in the yield or quality of Clark's No. 1, Burbank's Seedling, Mammoth Pearl, White Star and the Early Rose; they are just about alike in yield. The Clark's No. 1 matures the earliest of any potato.

As we are on the root crop I will say a word in regard to carrots. Five years I have raised carrots and five years I have planted them on the same ground; half of it never was manured but once, half of it has been manured twice. I find that the White Belgian yields the most in bushels, but the stock relish the Long Scarlet the best and I believe they are the most profitable to raise. You can grow almost as many bushels of them as of any kind by cultivating deep and manuring.

Mr. Niles: I raised the Mammoth Pearl, Burbank's Seedling and Early Telephone. These varieties averaged about the same—about two hundred bushels to an acre with good culture. On another patch with no cultivation whatever, I got at about the rate of one hundred bushels to an acre. They were smaller, but they were very fair in quality; very dry and mealy.

The following paper was then read:

HAY RAISING ON THE PLAINS.

BY J. G. MARSH.

In the spring of 1879 I broke two and a half acres of virgin plains land and planted it to various spring crops, but nothing except a few potatoes made out to live, and I only harvested five bushels of them.

In 1880 I cross plowed the piece and planted to potatoes and garden truck, getting a crop including one hundred and seventy-five bushels of potatoes which would have brought the next spring $100.

In 1881, June 16th, I planted two acres of this ground to Dent corn and harvested what you might call a good crop for this country—eighty bushels of hard corn, twenty bushels soft corn and a heavy growth of stalks. Crop was worth $100.

In the spring of '82 I plowed the two acres seven inches deep, smoothed it down and sowed two bushels of spring wheat, sixteen pounds mammoth clover and six pounds timothy seed. The wheat was thin on the ground with a good growth of straw, yield not over ten bushels to the acre. The two acre crop was worth $30, and I had the ground as well seeded as any one could ask for.

In the spring of 1883 I sowed on this plat three hundred pounds of land plaster, this being the first and only fertilizer used on the land. The growth of that piece of grass during the summer was the comment of all who saw it. I harvested four tons of hay worth $60.

In June, 1884, the frost injured the clover, killing it entirely in spots, but the timothy filled the vacancies and my crop averaged one and a half tons per acre, and having less clover in it and hay being higher, was worth $60.

In 1885 the clover was nearly all gone, nevertheless I mowed it, getting one and a half tons from the two acres. This was worth $24.

In the spring of 1886 I plowed the old sod under and planted potatoes. As the early part of the season was very dry the sod did not rot readily and my crop was only one hundred bushels, worth $50.

This made the eighth crop from this piece with no other manure than the one dressing of land plaster before mentioned, the total value of the eight crops being $427.75, an average of $26.73 per acre per year. The average yield of hay for three years was 2,833 pounds per acre, worth on the average $24.

[These results may perhaps be more readily seen from the following table.—EDITOR.]

1879.	2½	acres	potatoes, 5 bushels @ 75 cents	$3 75
1880.	“	“	“ (175 bushels) and garden truck	100 00
1881.	2	“	corn, fodder and 100 bushels @ $1.00	100 00
1882.	“	“	wheat, straw and 20 bushels @ $1.50	30 00
1883.	“	“	clover and Timothy, 4 tons @ $15.00	60 00
1884.	“	“	Timothy and clover, 3 tons @ $20.00	60 00
1885.	“	“	“ 1½ tons @ $16.00	24 00
1886.	“	“	potatoes, 100 bushels @ 50 cents	50 00
	Total eight years			$427 75

I have never had any success with June clover as a forage crop; have tried it two years in succession, using a bushel of seed each year and have not succeeded in getting together a ton of June clover hay.

I have tried seeding with most everything except rye. Two years I tried with winter wheat. The clover came up well in the spring but was nearly all gone at harvest time. A new breaking does not catch clover well. The third plowing is soon enough to try seeding.

The best way to seed down our land is to prepare it well and sow the seed alone; or, if you must raise some other crop the summer that you seed, try spring wheat or a half pound of turnip seed per acre.

The 17th of last June I sowed two and one-quarter acres to Mammoth clover and Timothy and mixed in one pound of Yellow Globe turnip seed, and now have as nice a piece of young clover as any one need ask for, and in the fall I pulled from it two hundred and fifty bushels of turnips.

I do not think much of millet as a forage crop. It will not choke out the growth of ferns, etc. I have tried two crops of it, getting about half a ton to the acre of millet and about one ton per acre of huckleberry and sweet fern roots.

Corn would pay well enough as a forage crop if we could only devise some plan to cure it. I never yet have been able to get it dry enough to keep when put in the stack, and I would rather have a few hundred bushels of rutabaga turnips and carrots to feed my stock than any amount of rotten cornstalks.

Mr. Alexander Wayne: I find no trouble in seeding with wheat or rye if it is properly done, and have raised large crops of clover, but I prefer to seed entirely alone on the third plowing, and have cut as high as two and one-half tons per acre of June clover. Timothy I never sow. The best way is to always seed alone after third plowing, about the last of May. I usually cut two crops of hay and then plow under for corn and potatoes. I never raised roots. Prefer wheat and hay. I have no particular method of rotation but crop till I think it needs seeding. I have not had a soil that is capable of bearing many crops. I generally crop two years before seeding and then mow two years. If hay fails one year I mow another year. Last year the hay crop failed on account of the dry weather. I could dig two feet and a half or three feet into the ground and it would be as dry as ashes.

President Willits: I would like to ask Mr. Wayne what his soil is?

Mr. Wayne: My soil is what is termed plains. It is a light gravel streaked with heavy gravel. In plowing eighty rods you will probably strike three or four different soils. Some will apparently be soft—a horse will go down—it will probably be six feet across it, but the main soil is an ordinary heavy gravel.

Mr. Sanders: Any clay?

Mr. Wayne: I have never plowed any clay up that I know of. I dug a well one hundred and ten feet deep and I have not struck any clay yet.

President Willits: Did you use any manure?

Mr. Wayne: Only on my orchard.

Mr. Lounsberry: In the county east of this the best farmers always put corn on clover sod and cultivate it, but never summer fallow, as a summer fallow dries out all the vegetable matter in the soil. They always put in after corn, spring wheat and clover, then potatoes, and then spring wheat or barley, seeding with clover for the next corn, and keep going right around in that way.

Pres. Willits: Never use manure?

Mr. Lounsberry: No; it is the exception that we can get any fit manure.

Mr. Reynolds: What follows the corn?

Mr. Lounsberry: Their spring wheat, and the sod next year, and potatoes the next year, and then they seed with spring crops, mostly spring wheat or barley.

Mr. O'Dell: I suppose I have thrown away about as much clover seed as any other man in Crawford county. I have tried to get a catch of clover in many ways. With turnips I have always had good luck, but the best seeding I ever had was following wheat, when I fitted the land just as I would for wheat again and sowed clover alone. I raised two tons to the acre and I never saw a failure yet in that way.

Mr. Webber: What time in the fall do you sow?

Mr. O'Dell: In August, or as soon as my wheat is off.

Mr. N. H. Evans then spoke as follows on

CORN.

I have raised corn for the last five years, both with and without manure. I have raised the Dent, Dutton, King Philip, and what is called the Little

York State. I find the York State corn is the corn for us to depend on in this country. It is a small ear, but it is reliable. I can't succeed with the King Phillip or the Dutton; they don't get ripe with me. I had corn one season on new breaking, and while it did better than I expected, it was not a paying crop. I have had corn on the second and third plowing, when I was quite well satisfied, but I think we cannot raise corn here, at the present time, at least for market; nevertheless I cannot afford to do without growing corn for use on the farm to feed through the winter to stock, and the stalks I consider worth as much to feed as the corn. In preparing ground for corn I have a roller follow the plow before harrowing at all; then I harrow thoroughly and then put the roller on again. I generally roll twice and then plant my corn. While I have not given corn raising without manure a thorough trial, yet, as far as I have tried it, it has satisfied me so that I intend to raise corn, or at least try it, every year.

Dr. Beal: In this section do you plant any deeper than they do further south?

Mr. Evans: About the same. I like to plant early, so that the corn won't dry out, so I plant about two or two and a half inches deep—deep enough so that it won't get touched with the frost when first starting. I plow seven or eight inches for corn, roll thoroughly, plant about four feet apart, and intend to get about three stalks in a hill.

Mr. Sewell: I have had twelve years' experience in raising corn in a corn country, and find that it requires a good deal of attention when it is young or it will not amount to much. The quicker I can get into my corn with the cultivator the better success I have. I found this out in cultivating forty acres of corn; in going to the back part of my field to get a drink of water I kept the cultivator going each time as I went back and forth over and over the same piece of ground, and it made ten inches difference in the growth of that corn compared with the piece by the side of it that I didn't go through so much (or on the average so early), and it made about one-fourth difference in the length of the ears when I came to harvest it. I think in this country because the weeds don't grow, the farmers don't go through their corn soon enough; the earth needs moving whether there are weeds or not.

Mr. Rose: My experience with corn is very much like Mr. Evans'. I have tried four different kinds. I sent to D. M. Ferry for the earliest corn he knew anything of and he sent me what he called the Early Compton. I planted it beside our celebrated York State corn, before referred to, and when the New York corn was in silk and tassel the other hadn't got started yet; it merely had a big leaf and that was all. I planted three inches deep May 1st to May 15th. It is not a paying crop, but as Mr. Evans says, I am going to raise it for the sake of the stalks and to have some corn on hand.

Mr. Evans: I planted the 8th of June last year, and raised the sample exhibited on the platform.

Dr. Beal: When did you harvest?

Mr. Evans: After the frost had cut the leaves; I can't remember the time. It was later than the first of September.

Dr. Kedzie: I was here during the State fair the 20th to the 22d of September and the frost was here the night before I got here.

Mr. Evans: It seems to me it was not as late as that, but the frost had cut some of the leaves very much.

Mr. G. W. Love then presented the following paper on

SMALL FRUITS.

Well do I remember my boyhood days in old Susquehanna county, Pennsylvania, how the meadows would be red with the tempting strawberries, tempting to our young eyes, and to our taste irresistable. But they were forbidden fruit to us, for fear that we would tangle the grass. How many a Sunday, while our parents were at church, have we Young Americans stolen along the fences until we could find a hole low enough down for us to get through without being seen, where the grass would hide us by our keeping ourselves close to the ground. We would crawl around, leaving the grass flat, and there we would pick and eat the beautiful berries, happy as kings, until we had our fill, or until our mouths would get so sore from the sour berries that we could eat no longer, and then we would steal our way back again.

Every farmer can have strawberries and other small fruits for home consumption, but when it comes to growing for market, and depending on the profits for a living, very few will make it a success in the end.

The wise man is content to begin on a small scale. He learns from his neighbors who have had experience, what kinds are best suited to his locality, prepares his land thoroughly, plants carefully and cultivates well. He doesn't run after every novelty, but sticks to what he knows to be good, and before he knows it he grows into a large and profitable business, while others around him who thought they knew everything worth learning, spread their eagle to its utmost and went it blind, planting every new thing that came along, only to tear it out and throw it into the fence corners, have failed completely.

One of the causes of my friend's success, was that he didn't allow himself to be humbugged by the plant and tree agent; he wanted none of their impossibilities. If he wanted something that he was unacquainted with he went to headquarters, and bought of those who had a reputation to sustain. I presume that most of my farmer friends have met with this agent of impossibilities, hence it is not necessary to describe him.

And now, Mr. Chairman, I will give a short list of the berries that I have cultivated in Center Plains township:

Of blackberries I have found but one that will stand the winters on the plains, the Agawam. It is a very good berry, of medium size. The Snyder kills half way to the ground. The Taylor and Western Triumph, with several others, kill to the ground. I once got a few Kittatinnies. By taking boards in November and putting them against the canes and bearing them to the ground, leaving them to snow under with the boards on them, I wintered them safely, but they are not adapted to this climate.

Black Caps.—The Mammoth Cluster and Doolittle are perfectly hardy and good bearers. The Golden Cap is hardy, a good berry and a very good bearer. Gregg and Miami can't stand it—they kill—but in the timber I think they would be all right.

Of currants the red and white Dutch and red Cherry currants do well and bear well. The black currant is perfectly hardy and a great bearer. I have Fay's Prolific, perfectly hardy, but it has not come into bearing.

Of gooseberries I have but one kind, the Houghton, iron-clad and very prolific.

The Concord grape-vine, if laid on the ground, will go through all right, but they are too late for this locality.

Out of thirteen different kinds of strawberries on my grounds I will give a list of six. I prize them in the order named: 1st, Wilson's Albany; 2d, Crescent Seedling; 3d, Downer; 4th, Chas. Downing; 5th, Captain Jack; 6th, Green Prolific.

The Wilson is said by some to be run out. I can't see it. I know they are badly mixed with other sorts all over the country. It is only here and there that they can be found pure. You need have no fear in setting out the pure Wilsons. It is said that they are too sour, but that is because they are picked for market before they are ripe—only a pale red—leave them until dark red and then try them; you will change your opinion, I think.

The Chairman: The time is so short it will be impossible to discuss the papers presented.

CULTIVATING THE PLAINS.

BY W. C. JOHNSON OF PERE CHENEY, CRAWFORD COUNTY.

Brother Farmers, there is such a diversity of opinions on cultivating the plains, that I shall not theorize on the subject, but shall give you the plan I have followed for the past six years.

1st, I grub the land. 2d, I plow as shallow as possible to turn the sod (applause), that is from three to three and a half inches for the first plowing, four and a half to five inches at the second plowing and at no time more than six inches deep. 3d, harrow the soil, leaving the roots in the ground. 4th, seed to grass on the second or third plowing. My opinion is that the best time to break the plains is in the months of July and August. The second best in June and September, and the more we stir the soil before putting in the crop the better.

Now a word as to the results of my system. I have 70 acres without a stump or a grub on them, and they have paid the entire cost. The past season I plowed six acres of the first year's breaking (1880) and although a poor season for crops on the plains, I received one-third more than from any crop before from the same land.

I have used no manures except that made on the farm and have not bought or used any commercial fertilizers except fifty pounds of superphosphate the first year, which did not pay.

The question asked in regard to frosts was not answered. As I have it in my memorandum, I will give it to you for the following years:

1880, May 6th and September 7th.
1881, June 9th and October 5th.
1882, May 13th and October 10th.
1883, May 20th and August 27th.
1884, May 28th and August 8th.
1885, May 10th and September 11th.
1886, June 6th and September 1st.

The only June frost that has done much damage was the 6th, 1881.

The August frosts have done no damage except in places.

I have been asked to make a statement in reference to my last year's crop of White Russian oats. They were raised on as light soil as the plains produce. The land was first broken in 1880 and planted to fodder corn, followed by two crops of winter rye. Then it received a light dressing of manure, two loads per acre, and was planted to potatoes, then seeded to clover with spring wheat, then plowed up last year and put in to oats. I sowed 1½ bushels and received 28 measured bushels, weighing 36 pounds to the bushel.

Mr. Rose: In regard to plowing I will state my experience. My first plowing was seven inches deep, a narrow furrow and return. Some one said to me "That's a good deal too deep." We had plowed about one acre. So we made the next acre about four inches deep. It was measured, and not guessed at. Before I got through with it some one else said, "You are plowing a good deal too deep, I would not plow over two inches and a half." Well, you know the old fable. So I fixed the wheel again and only plowed about two inches and a half. That disgusted me, and I put it down again about four inches and finished up pretty well satisfied that the first plowing was better than all. The next year, however, I began to see the result of the three depths of plowing. A good crop of our natural ferns and dwarf whortleberries, and everything that it had grown before it was plowed, came up through the seven-inch plowing; less in the four-inch plowing and not any of it came up in the two and a half-inch plowing; the seeds were thoroughly rotted and the brakes were all killed. On second and third plowing I would go deeper. Our soil is not 110 feet deep. It is only 6 to 11 inches deep.

CATTLE RAISING.

Mr. Head: I didn't prepare a paper on live stock for the reason that I didn't feel equal to the task. I would say, however, that my little experience in stock-raising in this country has been satisfactory to me. We commenced with one cow and we have her yet and 69 more.

Mr. Willits: How many years have you been on the plains?

Mr. Head: It will be twelve years the eighth day of next July since we got our first cow, and ran in debt for her.

Mr. Rose: This subject is the key to the solution of the problem of the plains, and if possible I think there should be time given for the discussion of the subject, as Mr. Head has occupied so little time. It was for the purpose of starting a stock farm that I came north. I brought up some twelve or fifteen head of cattle.

The coarse natural grasses here are splendid for every kind of stock except horses. Horses don't seem to do well here. The cattle I brought here I fed nothing but the marsh grass that I cut and they came out in good condition in the spring. The people in the southern part of the State have got an idea that the winters here are so long that cattle can't be raised with profit; but my experience here is this: I had brought with me grain to feed, and I had a good supply of blue joint hay and I gave them a good chance through the winter, and on the 13th of April, before the snow was half gone from the ground, I let them out to the ground. There are two or three kinds of grass here that remain green all winter, and as quick as they got a taste of those grasses they would not come up one hundred rods to get their hay and meal. I didn't put any bells upon them and they wandered off and were gone five days before I could find them. I found them three or four miles from home and they were in better condition then than when they left. From that time onward I didn't have to feed them anything. By the middle of April every year I find that they need but very little more feed, for they can roam over the plains and pick up a living and do splendidly, and by the first or middle of June the later grasses get started and by the first of July they will get fat enough for beef.

The trouble with our soil is the lack of vegetable mould. It has been stated here that the fires have burned up the vegetable matter. As I was driving my cattle across the State from below Grand Rapids I examined all kinds of soil, and the poorest ground was down in "God's country," as they call it down near Grand Rapids. I found all the way up this same formation; and I don't think you can distinguish the soil at all from the kind of trees that grow upon it. I find this jack pine we have been talking about growing upon all varieties of soil wherever they get a chance. But the vegetable mould here has been burned up and not replaced, though the other elements of fertility are present. We must replace that vegetable mould, and how is it to be done? To solve that question is the object for which we have met here. In my opinion, clover and green crops turned under are going to do it, and make this whole country a paradise. But we want something besides this. We can't send our cattle roving over the plains and bring them home nights and yard them. We must have root crops. I believe root crops are going to be our stronghold, and we must feed them to stock for the manure. When I was coming up here I stopped at a good looking farm-house, and the lady of the house told me that they liked the country, and were getting along very well. She said, "We nurse our land just as we would a baby." There is the secret of it. We must nurse our land just as we would a baby. We don't want to come up here and crop and crop and take off all we can get; we want to put something back on the soil to make it grow better, so that when our children come after us they will find the land enriched and growing better all the while. That must be done by stock. Stock-raising and grain-raising must go hand in hand.

FRUIT.

Mr. Wayne: Apples will grow here, quite a variety of them. I set out an orchard of 25 trees five years ago and 11 out of the 25 have winter-killed and the balance look well. They have borne fruit for three years. Plums do extra well. I have had three crops. As to small fruit, of currants, gooseberries, blue berries and raspberries, you can raise any quantity. Last summer I had about two rods by six rods of black caps, Mammoth Clusters, and I sold 100 quarts besides using a bushel or more in my family. They do better here, I think, than in the southern part of the State. I know strawberries do exceedingly well, they grow wild upon the plains all over. Wild huckleberries are very abundant. They fail us some seasons, but I don't know why. Our native fruits produce from very small plants.

Dr. Beal: Our professor of horticulture, who is not here, is taking a good deal of interest in improving huckleberries; he is devoting quite a spot of land to it, and he proposes to get a larger berry than we have ever found. It is a matter worth talking of.

Mr. Evans: Four years ago I set out fifty apple trees. They did well for two years. I thought I was going to succeed. A year ago this last winter we had a very cold spell, with the snow two feet deep, and the trees froze at the top of the snow. The bark finally dried up at that point and the trees died. They remained alive at the top and bottom for some time after the freezing. They all did well until that winter and all but five or six froze out that winter. They were said to be hardy trees, some of them Russian apples. I have thirty cherry trees that I set out about the same time, the common red cherries, and they look well but had no cherries on last year. My land is level and of medium quality. On the hills fruit does better. Red raspberries, grow wild in the woods and are very nice.

Mr Love : I have found but one apple that we could say was perfectly hardy. It is the Transcendent crab apple. It grows about the size of a common hen's egg and has red cheeks on one side. It is a good cooking apple, and, for a person who is fond of sour apples, it is a very good eating apple. I have one, and through each of the cold winters we have had for the last four years it has come out perfect. I have dead stumps of the Duchess of Oldenburgh, Red Astrachan, Mann, Wealthy, Ben Davis and even of the Fameuse or Snow, though they did better than most varieties. On our highest hills many of these fruits will grow and sometimes even peaches.

Pres. Willits: Prof. Bailey, professor of horticulture at the Agricultural College, has begun a line of experiments in regard to hardy peaches and other fruits. He wants to find a peach that will live even in Northern Michigan. He believes that apple trees and peach trees which will furnish good, decent fruit can be raised here. Last winter he went north beyond Manistee to study the subject. And our hope is, if we succeed in getting the appropriation I shall speak to you about before I close, to have an experimental farm right here. We must get a tree that will be hardy here; we have got to do it, and to that end it should be developed here. Another thing for such an experimental farm would be the study of the best grasses for your country. These things need to be worked at right here. There are thousands of acres here that have been cried down in the southern part of this State, and I don't believe but that there is some virtue in them, and we want to prove it. The college farm is a very poor one for peaches; I don't know but experiments there with peaches would be as well as here. I think there is no peach that is cultivated thus far in Michigan that will stand our climate safely, but we yet hope to see such a peach.

Mr. Love : Have you tried the Weaver peach?

Dr. Beal : I think not.

The chairman here appointed the committee on resolutions, and also a committee to consider the formation of an agricultural society; whereupon the meeting adjourned until afternoon.

Afternoon Session.

Mr. Van Buskirk, of Harrisville, Alcona county, presented the following paper on

THE CULTIVATION OF PINE STUMP LANDS.

Mr. Chairman, Ladies and Gentlemen—I consent to make the attempt to tell you what I know about farming, on condition that only experience and not theory is expected from a mossback.

I have been lumbering since 1868, and not until 1874 did I conceive the idea of utilizing the lands that had been lumbered for farming purposes.

I first cleared off about ten acres of stripped or lumbered-off lands and prepared it for fall wheat. A portion of this field was white sand and the balance gravelly. The timber had been white pine and hemlock. I put in fall wheat and, to my surprise, in two weeks I had a splendid crop of brakes, six to eight inches high. My neighbors on the clay farms about two miles distant began to poke fun at me, and the only way I could sneak out was by telling them that I was cultivating a valuable plant that I expected to make my fortune out of and would show them in the near future how valuable my lands were. In the spring, before the snow had disappeared, I sowed clover seed, and despite the brakes I had about ten bushels of good wheat to the acre.

The next season I pastured the field and in October turned it over for a spring crop. When spring came I put it into peas and it bore about fifteen bushels of peas to the acre. The brakes this time were not quite so persistent, but maintained their inherent right to the soil. I plowed again in the fall and sowed to oats in the spring. The result of this crop was twenty-six bushels to the acre. Plowed again in the fall and in the spring put in spring wheat and seeded down with two-thirds clover and one-third Timothy. Only a few brakes appeared and when I took off the wheat the clover was so high that the tops were clipped off while cutting the wheat. I threshed twenty-five bushels of as pretty spring wheat to the acre as I ever saw. The next season I cut one and a half tons of hay to the acre. I have since subdued other pieces of even lighter soil.

But I have been told by my neighbors that it required capital to make a farm from the light soil. That is true; but you have the advantage of first finding your lands nearly cleared; and what man is there so poor that he cannot take on contract from his employer a 40 acres of stripped land, agreeing to pay when he can $100.00 with 7 per cent interest. (I am speaking now more particularly of the men who work in the lumber woods and mills.) If he is an honest, industrious man he will have no trouble in getting lumber enough to put up a small house from his employer. Now comes the fight for a home of his own; he has some incentive; he has something to work for. He buckles in with a will when he has a chance to lay off between the time the mill shuts down and the time to go in the woods. His good wife goes out and holds one end of the board while he nails the other, and they soon have a home; then they both together clear around the house, and a patch of potatoes is planted in the spring. The wife puts in the cabbage, onion, turnip and other seeds, and tends the plants as well as the potatoes while the husband is off working in the mill; and Saturday night he comes home with flour, tea, sugar, etc., leaving with his employer as much each month as he would have paid for rent in town to apply as payment on the farm. Another acre or two is cleared in the fall, and in the spring millet is sown on last year's potato ground, and the new piece is put into potatoes. And now they need a cow, because perchance a brand new baby has put in an appearance; and, of course, the millet will keep the cow next winter, and the cow will keep a pig, and the mother will keep the baby, and the father will keep them all, and they all will keep the farm. Now I have pictured out to you a farmer that has succeeded.

I have shown you in this man principles of success. Whether on sand or clay a man must have a heart in the work if he will succeed. The proportion of men who attempt farming that make a success of it is much larger than in any other pursuit. You say, "Why?" Because the improvements made on the farm are permanent, and are not easily bartered away. If a farmer could sell out and jump the country every time he gets the blues, there would be a much larger proportion of farmers fail. But they are compelled to stay or lose all, and so they take a new lease and work out of debt and the farm enhances in value, and before they are aware of it, they are called independent farmers.

One great principle of success in farming is system in cropping. I call to mind an instance in my neighborhood of injudicious cropping. A poor man clears off an acre of ground around his new log house and sows it to oats. He has no domestic animals to consume the crop. He can't eat it himself, and to thresh and sell the crop, it virtually amounts to nothing. What he should have done was to put in potatoes, cabbage, rutabagas, sweet corn, peas, beans, etc. Then when a field is cleared well enough to seed down, give it a lay off--a rest; pasture it one or two seasons and then turn it over to give it a rotation of crops. Don't sow oats after oats, especially on light soils. Peas are the best on the sod, then oats, then wheat, rye or barley, and seed down again; then mow one or two seasons, and crop again, if you wish; or mow it and pasture as long as you can get anything off, and you will not run the soil out, because the droppings from the stock, together with the rest the land has, will keep it up. We should grow more stock and better stock than we do. Sheep are especially adapted to the high, rolling, light soils. The coarse wools, such as the Leicesters, Shropshires and Southdowns are among the best. As to cattle, there are so many good breeds that some insist one and some insist the other breed is best. The Holsteins are great milkers, and grow large, and are hardy in this climate. The Short Horns are fair milkers and of excellent fattening qualities. The Jersey is the cream cow, but is not profitable for beef. There are other excellent breeds, such as the Herefords, Polled Angus, etc., but I am not so much acquainted with them. Stock is essential to good farming on any soil, but indispensable in light soils.

I could give some valuable experience on the keeping of store hogs, but I have occupied too much of your time already.

Dr. Beal: I think those present would like to hear Mr. Van Buskirk's experience in feeding swine.

FEEDING HOGS.

Mr. Van Buskirk: I raise mostly Poland Chinas and Berkshires, and crosses from them.

When I have to keep hogs over for breeding purposes, the way I feed is to take clover hay and cut it in a cutting box and put it into a kettle with enough water to cover it nicely and let it steep two or three hours over a slow fire. The tea from that is very rich, and hogs or calves like it very much, and the hogs will eat up every particle of the hay after you have dipped off the tea, and you may dip up the hay together with the tea into a barrel and mix a little bran with it. I have kept ten hogs over winter with a half ton of bran, and they came out in nice shape in the spring. We fat our hogs altogether on peas, using them instead of corn. We don't raise corn at all except in the garden for the table, because we can raise peas so much easier. The crop can be harvested much easier and threshed with a machine and then it is done with, and the peas are in the bin all ready for grinding or feeding, and we think them as good or better than corn for horses or cattle.

The chairman then introduced Dr. R. C. Kedzie, who presented the following paper on

THE AGRICULTURAL PROBLEM OF THE PLAINS.

BY R. C. KEDZIE.

The agricultural possibilities and probabilities of the northern counties of this State where lumbering has ceased to be a leading industry, and men turn their eyes from the trees on the land to the soil out of which they grew, have occupied the minds of many persons in our State. What will be the history of these new counties when the forests have been swept away? Will they be remanded to the care of nature until clothed with new forest growth for the use of a new race of lumbermen, or will the plow and the reaper take the place of the ax and the saw-mill?

Their northern position, their elevation above the level of the sea, and the peculiarities of climate arising from these causes have complicated the question somewhat, but the general conclusion has been that a soil and climate that will produce vigorous forest growth can likewise produce crops if properly handled.

But when we turn our attention to "the plains," destitute for the most part of forest trees, or producing jack pines and scrub oak, with here and there a Norway pine, the signs for a bright future for agriculture are less obvious. A wide diversity of views prevails in regard to their value. Some regard these lands as utterly useless—smitten with perpetual barrenness—and any attempt to bring them into notice for agricultural purposes is only to excite hopes incapable of fulfillment, inducing the improvident and credulous to embark in an enterprise whose only outcome is failure and ruin. "Why encourage poor devils to settle on these lands, invest their all in a hopeless undertaking and waste years of toil, when the certain result will be bankruptcy and heart-break? Why hold out a hope

That leads to bewilder and dazzles to blind?"

A sufficient reply will be that it is not proposed or desired to either awaken hopes or cause fears, but to gather facts upon which to found an intelligent and reliable opinion in regard to the soil of the plains. Truth will not harm the innocent. If it is true that these lands contain all the elements of fertility, only requiring some peculiar mode of treatment to develop their resources, if knowledge, patience and skill shall yet fill these plains with smiling homes, and these pine barrens shall yet be clothed with flocks and wave with grain, this should be known, and the State receive the full benefit of such knowledge.

On the other hand, if these plains are worthless and useless for agricultural purposes, a snare and a delusion, if there is anything in their composition, position, or climatic condition which forbids their successful cultivation, then in mercy to any and all who propose to make a home in such inhospitable wilds, such facts should be known, clearly and unmistakably. Concealment would be cruel. Be the conditions what they may, hopeful or hopeless, the public have a right to know the exact facts in the case.

In order to bring out the facts in the case a careful, impartial and extended investigation is required. Persons in whom the public have confidence, and who have no pecuniary interest in the results should be placed in charge of such investigation, with means sufficient to make it thorough and exhaustive. The object should not be to cry up or cry down these lands, but to determine their real value and the conditions under which they may be successfully cultivated. The pioneer has neither the time nor money for such investigation, and he ought not to be expected to make it. The natural results of imperfect and inadequate trials of this class are seen in the hundreds of abandoned homesteads that dot the plains and are a disgrace to the State. If this is the necessary result of attempts to cultivate the plains, let us know it and avoid it; if unnecessary, let us know it and cure it.

The State owns hundreds of thousands of acres of these lands and would be the party most benefited by settling these questions, and it is just and fair that the State should undertake and carry forward this work to a satisfactory termination. Let the hardy pioneer receive the benefit without bearing the crushing burden of this investigation, and let the State receive her benefit in the multiplied homes and increased inhabitants, or else in the satisfaction of that feeling of parental guardianship that saves her sons from financial loss in a hopeless enterprise.

FORMER INVESTIGATION.

Nine years ago I attempted an examination of the characteristic soils in our State, endeavoring to secure a fairly representative specimen of soil from each county for chemical analysis. The effort was not very successful, only thirty-one specimens of soil being received. The specimens included some of the best and some of the poorest soils in the State. The thirty-one specimens were analyzed and the results published for public information in the Report of the Board of Agriculture for 1878. I do not propose to reproduce these results, except that a few of the soils were light sands, similar to the soil of the plains, and I introduce them for comparison with the soils now under consideration.

THE PRESENT INQUIRY.

Last September I visited Crawford county, examining the soil and productions, gathering specimens of soil for analysis and grasses for identification by Prof. Beal. In November I visited Iosco county for the same purpose. Seven representative specimens of soil then collected were carefully analyzed. The results of analysis of these soils, together with five soils of a similar class analyzed in 1878, and one soil from the Campine sands of Belgium, are given in the following tables. The soils are before you in glass jars, except that sand from the pine barrens of New Jersey replaces the similar sand of Belgium. The physical qualities of the soils you can directly compare by examining these jars, and these tables tells you their chemical composition:

RESULTS OF ANALYSIS OF SOILS FROM "THE PLAINS" OF CRAWFORD COUNTY., MICH.

No. 1.—Soil from O'Dell's farm. Virgin soil:

Sand and silicates, insoluble in acid	93.661
Oxide of Iron	2.100
Lime	.500
Magnesia	.064
Potash	.970
Soda	.470
Sulphuric Acid	.015
Phosphoric Acid	.120
Organic matter containing .08 Nitrogen	2.100
	100.

Capacity to hold water 31 per cent.

No. 2.—Soil from Metcalf's farm. Cultivated three years:

Sand and silicates insoluble in acid	93,010
Oxide of Iron	2,370
Lime	.340
Magnesia	.090
Potash	.870
Soda	.330
Sulphuric Acid	.020
Phosphoric Acid	.070
Organic matter containing .08 Nitrogen	2.900
	100.

Capacity to hold water 36 per cent.

No. 3.—Soil from Steckert's farm. Virgin soil:

Sand and silicates insoluble in acid	95.042
Oxide of Iron	1.430
Lime	.300
Magnesia	.072
Potash	.970
Soda	.210
Sulphuric Acid	.010
Phosphoric Acid	.066
Organic matter containing .05 Nitrogen	1.900
	100.

Capacity to hold water 34 per cent.

No. 4.—Soil from Hanna's farm. Three years in buckwheat:

Sand and silicates insoluble in acid	94.206
Oxide of Iron	2.020
Lime	.320
Magnesia	.060
Potash	.950
Soda	.280
Sulphuric Acid	.024
Phosphoric Acid	.060
Organic matter containing .06 Nitrogen	2.080
	100.

Capacity to hold water 33 per cent.

No. 5.—Soils from Iosco county, two from abandoned homesteads, and the other from the open plain. Soil from Gray's homestead. Virgin soil:

Sand and silicates insoluble in acid	94.330
Oxide of Iron	2,160
Lime	.480
Magnesia	.057
Potash	.630
Soda	.140
Sulphuric Acid	.008
Phosphoric Acid	.095
Organic matter containing .05 Nitrogen	2.100
	100.

Capacity to hold water 31 per cent.

No. 6.—Soil from Dawe's homestead. Virgin soil:

Sand and silicates insoluble in acid	95.364
Oxide of Iron	1.200
Lime	.310
Magnesia	.061
Potash	.850
Soda	.240
Sulphuric Acid	.017
Phosphoric Acid	,088
Organic matter containing .07 Nitrogen	1.870
	100.

Capacity to hold water 32 per cent.

THE CHEMISTRY OF THE SOIL.

Much has been written on one side and the other about the value of a chemical analysis of the soil, some claiming that such analysis will settle every question in regard to the capacity of the soil to produce crops; others saying that it is of no value, and entirely misleading in its teachings. In this, as in most discussions, the truth is found between the extremes. While it is true that a soil may be abundantly supplied with all the chemicals of agriculture and yet be incapable of raising satisfactory crops, it is equally true that in the entire absence of any essential chemical of plant growth, agriculture will fail. By analysis it is determined whether the elements absolutely essential for plant growth are present in any soil, and thus settling the question whether the soil is capable or incapable of producing crops under any circumstances. For example, if any land is destitute of lime, potash and phosphoric acid, we know such soil must be unproductive so long as these substances are wanting, and such soil will remain barren until these substances are supplied in some form. If the land contains all the chemicals of plant growth in sufficient quantity, we may safely say that other things being favorable, such land will produce crops.

One writer seeks to show the impracticability of chemical analysis of the soil by pointing out the fact that an acre of soil taken to the depth of one foot weighs four million pounds; that the application of two hundred pounds of guano or superphosphate may double the crop; yet this dose of manure is only one twenty-thousandth part of the soil to which it is applied. The chemical test is only one in twenty thousand, while the agricultural test is one in two! But the larger part of the soil is insoluble in acids, usually not more than five per cent, and seldom more than 10 per cent, is soluble in acids, yet it is in the soluble part that we seek the most important chemicals of agriculture.

THE PASSIVE AND THE ACTIVE CONSTITUENTS OF SOILS.

The largest part of soils in this State is made up of materials insoluble in hydrochloric acid, which are of little or no value in agriculture aside from their physical properties, having no direct relation to vegetable nutrition. Sand and clay make the great bulk of all our soils, and as one or the other predominates we have an open and porous soil, or a compact and tenacious soil. Clay forms no part of the ash of cultivated plants, and silica is considered to be of very little importance, though found in the ash of all plants. Even in very fertile lands the matters insoluble in acid (sand and clay) make up 90 per cent of the mineral matter of the soil. They are the *passive elements* of plant growth and, while of little value as a direct plant food, are of great value by reason of their relation to the physical properties of soils.

QUICK AND SLOW SOILS.

Where sand is the principal constituent in a soil it is called *light;* where clay predominates the soil is called *heavy.* For sandy soils I propose the name *quick* and for clay lands *slow.* The sandy soils are open and porous, easily tilled, quickly plowed and hoed, the water is quick to pass through, the crop comes up quick and matures early, the benefit of manures is sure the first season, but their action soon ceases. On the other hand clay is slow—slow to drain and dry, to plow and cultivate; it brings up its crop slowly and ripens it at its leisure; the action of manures is slow and lasting and the land is slow to wear out. I think *quick* and *slow* describes the two kinds of soil better than *light* and *heavy,* especially as a cubic foot of light sand weighs more than a cubic foot of heavy clay. The light soil is really the heavier!

QUICK SOIL OF THE PLAINS.

The soil of the plains is quick. Sand is the leading material, constituting about 90 per cent. of the soil, while clay makes only 2 to 5 per cent. Such land has all the advantages and disadvantages of a quick soil and requires the treatment demanded by quick soils to secure satisfactory cropping.

EXPLAINING THE ANALYSES.

On referring to the table of analyses, you see how large a per cent. of these soils is insoluble in acid—the passive elements of the soil. Then follows a list of substances in relatively small amount which make up the active elements of plant growth. Some of these are in very small amount—so small as to seem of little account. But when we consider the large amount of material in an acre of soil, we see that this relatively small amount becomes an absolutely large amount to the acre. If we call the weight of an acre of soil one foot deep, four million pounds, we see that .06 per cent. of magnesia, (Hanna) means 2,400 pounds to the acre, enough for a full wheat crop for 300 years. A soil that holds only a fraction of a per cent. of some chemical of plant growth may still contain an immense store of plant food.

A soil that has a relatively high percentage of lime, potash, phosphoric acid and combined nitrogen usually shows a high degree of productiveness. But as Hilgard has shown, it does not follow that low percentages necessarily show low production. A heavy alluvial soil of high percentage of ash ingredients will produce a maximum crop under favorable climatic conditions. If we add to this soil an equal weight of clean sand, thereby reducing the ash percentage one-half, the crop will not be reduced one-half, but may still produce a maximum crop on account of the improved physical condition of the soil. In open and porous soils the roots of plants will be longer and better developed, will penetrate the whole mass of the soil and thus reach and appropriate as much food as in the rich but compact soil. A relatively low percentage in quick soils will produce as good crops as a high percentage in slow soils.

Let me now call your attention to each of the chemicals found in soil analysis.

Oxide of iron.—The amount of oxide of iron in the ash of crops is very small. A few pounds at the most will cover the year's expenditure in the crop on each acre of soil. While this amount is indispensable for the growth of the crop, this does not measure the whole value of oxide of iron in the soil. Practical men recognize the fact that red land is better than white soil. Compare these soils from the plains with the sand from New Jersey pine barrens. The singular powers of oxide of iron to take up and hold in soluble form potash, ammonia and phosphoric acid, and thus to prevent leaching of manures, and to retain moisture, and thus resist drought, are most valuable qualities in the soil. Yet oxide of iron tends to dissipate vegetable matter in the soil, and soils rich in oxide of iron must be carefully managed to accumulate humus. The abundant supply of oxide of iron in all the soils of the plains is a favorable indication.

Lime.—In the agriculture of the old world lime is held in high estimation, the British farmer using it in large doses. In the dryer climate of the United States, France and Germany, lime is used in smaller quantity, which seems to be as efficacious as the large doses in Great Britain.

In the fifth volume of U. S. census, 1880, Hilgard states that the lightest sand should not contain less than .10 per cent of lime, clay loam not less than .25 per cent, and heavy clay not less than .50 per cent, and that this percentage may advantageously rise to 1 or 2 per cent, but no increase beyond this amount seems to have any chemical benefit, but only to mechanically improve the soil.

By reference to the table of analyses you will see that the soil of the plains contains from three to five times the lowest limit allowed by Hilgard to light sands. Yet I have no doubt that these lands would be benefited by a liberal dose of lime, and the beds of marl scattered through this region give a hint not to be neglected.

The beneficial influence of lime in agriculture is very marked: It promotes the oxidation of organic matter of the soil and formation of nitrates; prevents the prongy growth of root crops or "fingers and toes" of turnips and other root crops, and accelerates the ripening of grain and fruit. Any manures remaining in the ground in the inactive condition will be made active and available by the use of lime.

Magnesia is found in all fertile soils, but the amount is often very small. While it is indispensable in plant growth, its influence is much less marked than lime, because of its inferior chemical activity. The amount removed in ordinary crops is small. If we take a crop of wheat (thirty bushels) barley (forty bushels) and oats (forty-five bushels), the grain and straw of these three crops would contain about twenty-four pounds of magnesia, or eight pounds an acre for each crop.

Potash.—All fertile soils contain potash in available forms. It is one of the most important chemicals of agriculture. No crop can be raised, or plant grow in the absence of potash. The amount removed in crops is much larger than the oxide of iron, lime and magnesia, being about forty-five pounds to the acre in grain crops, and much more in root crops.

The amount found in different soils varies widely. Clay loams contain .5 to .8 per cent.; light loams from .3 to .4 per cent, and sandy soils of great depth may fall as low as .1 per cent, and still be fertile. These are the estimates of Hilgard.

Referring to the tables of analyses, you see that the sands of the plains contain a good supply of potash, the lowest being .63 per cent (25,000 lbs. per acre), and the highest 1. per cent (more than 40,000 lbs. per acre). The abundant supply of potash in these soils, in connection with their great depth, is a hopeful feature in their agricultural possibilities. The Chemist of the Department of Agriculture says that a soil containing .125 ($\frac{1}{8}$) per cent should furnish potash enough for a century. On this basis, the plains should be good for five hundred to eight hundred years of cropping.

Sulphuric acid.—The sulphates are present in very small amount in the soils of the plains. It is only by using a considerable amount of soil that satisfactory reactions for sulphates can be secured. You will notice that the two soils that have been cultivated—Metcalf's and Hanna's—have more sulphuric acid than the virgin soils. A similar fact came to my notice many years ago in analyses of water from stations on the Grand Rapids & Indiana railroad, when I found the amount of sulphates in the water gradually increased from Mackinaw City to Fort Wayne. In the uncultivated regions the sulphates were in very minute amount, but where lands had been brought under cultivation the sulphates were found in increased quantity. A part of this increase came from the use of plaster on the fields, but a part comes from the oxidation of sulphide of iron in the soil, in consequence of cultivation. The well water at Grayling contains small, nearly insensible quantities of sulphates and sensible quantities of chlorides. The amount is so small in this general filtrate from the soil (well water) that I am inclined to think that good results will follow the use of plaster and salt on the plains when once the soil is subdued and adequately supplied with humus or organic matter.

Phosphoric acid is found only in small quantity even in the most fertile soils. The largest amount found by Hilgard in the upland soils of West Tennessee and Mississippi was .25 per cent. In the rich alluvial soils of the river Raisin bottoms I found .4 per cent.

Hilgard states that in sandy loams .10 per cent, accompanied by a fair supply of lime, secures productiveness, but that a soil containing less than .05

per cent must be regarded as seriously deficient unless accompanied by a large amount of lime.

By reference to the table of analyses you will see that all the soils of the plains rise above Hilgard's minimum, the average being .086 per cent, while the Campine sands of Belgium fall much below (.031).

The agricultural powers of these soils would be greatly increased by an increased supply of available phosphoric acid This may be be done by the use of commercial superphosphates. To get a satisfactory system of rotation of crops established, to get the soil, so to speak, on its feet and in a condition to help itself, these commercial fertilizers may play an important part, but the true policy is to make the soils self-supporting agriculturally, not fed or stimulated by imported supplies. I will call your attention to this subject before I close.

Organic matter or humus of the soil is a material of great importance in agriculture both from its physical properties in relation to heat moisture and texture of the soil, and because it is directly and indirectly the storehouse of combined nitrogen for plant growth.

In 1868 it was shown by a set of experiments on the temperature of soils, extending from the first of May to the first of October, that soils containing twelve per cent of organic matter are warmer by one and a half to two and a half degrees Fah. than similar soils destitute of organic matter. During every month of active growth the soils rich in organic matter maintained an average temperature much above that of similar soils under like exposure, but destitute of humus. This was no mere laboratory experiment, for the soils were exposed under agricultural conditions in the open field.

Many persons have observed that dark soils warm up quicker than light colored soils when exposed to the sun's rays. But humus does more than this; the soil not only warms up quicker but stays hot longer than soils destitute of organic matter. It is not only hotter at midday but warmer at bed time.

No other substance in the soil has such power to combine with and retain water as humus. It holds the rain, prevents its rapid drainage, and stores it up for time of need. Its influence in preventing or mitigating drought is of great importance in quick soils.

If you refer to the table of analyses you will find at the close of each a line that reads: "Capacity to hold water — per cent." This requires a word of explanation. If 100 parts of dry soil are weighed out, and water is poured upon this until the soil has taken up all the water it will absorb and hold, the amount of water thus taken up measures the capacity of the soil to hold water. This is done in each case for 100 parts of soil, and thus the capacity is measured per cent. This power of the soil to drink in and hold the water depends upon the fineness of division of the soil and the amount of organic matter. It measures the power of the soil to resist drought. In some very rich soils in this State I have found the capacity to hold water to range from fifty to seventy per cent, that is, one hundred parts of such dry soil would take up and hold in capillary form from fifty to seventy parts of water. Such soils contain from seven to twelve per cent of organic matter. On the other hand the sand from pine barrens of New Jersey will hold only twenty-five per cent of water. The soil from the plains ranges from thirty-one to thirty-six per cent. They should be brought up to a capacity of forty, which can only be done by increasing the amount of humus in the soil.

The organic matter of sands makes them more stable and resisting, and prevents the transporting action of the winds. Sands destitute of a matting of vegetable matter are at the mercy of the winds, as is seen along our lake borders.

The richest soils in our State contain from five to twelve per cent o organic matter. Porous soils would be better if they contained at least five per cent. Turning to the table you see that the soil of the plains is deficient in organic matter, only one comes up to 2.9 per cent, while three fall below two per cent. Reasons for this are not hard to find. The yearly fires which sweep over these plains burn up organic matter on the surface. and thus inflict incalculable injury, and the open and porous nature of the soil retards the accumulation of organic matter within the soil.

The remedies are obvious: Stop the fires; adopt such a system of cropping as will accumulate vegetable matter within the soil, and then compact your surface soil by the roller.

Nitrogen.—The amount of combined nitrogen in these soils is very small, ranging from .05 to .08 per cent, and the most of this is in the inert form, only an exceedingly small amount being in the active form of nitrates and ammonia.

From a chemical standpoint this is the weakest feature of these soils. The application of nitrogenous manures will develop striking results. Rotation of crops and a system of farm economy designed to accumulate combined nitrogen in the soil are matters of vital importance in farming on the plains. Green manuring, clover, turnips, stock feeding, etc., will occupy important positions in the agriculture of these lands.

The inquiry is often addressed to the College: "What shall we apply to these lands that will enable them to produce the same crops, and be farmed in the same way, as in the southern counties of this State?" When we attempt to import manures for a single farm we find quite a task. To manure a township is a heavy burden, but what will be the cost and labor of manuring many counties? We must attempt the solution of this problem of the plains, not by importing the materials to make these soils productive, but by developing their dormant resources. The line of inquiry should be: "What do they now contain? What can they produce in their present condition? How can we bring these soils by using their own resources to a higher state of productiveness? What system of cropping is best suited to these soils in this climate?" To make the soil feed itself is a central fact in farming.

CONCLUSIONS.

I am satisfied that these plains when properly subdued and skillfully managed will make good farms. They contain all the elements of fertility, and any deficiency can be supplied at small expense and by skillful rotation. With the same chemical composition in a slow and compact soil I should be less hopeful. But the quick and porous nature of this soil makes up for a smaller percentage of chemicals of growth by permitting a wider range of root distribution for gathering the ash elements for plant life.

The fact that red clover makes a good growth on these soils is full of significance. In all the range of plant life I know nothing that equals red clover as an accumulator of plant food. Its deep and wide reaching taproot explores the soil for plant food as with a search warrant; it is nature's man-date to the soil, *subpœna duces tecum*, bring the documents with you into open court! It is difficult to place the limit on the productiveness of a soil that will produce good crops of clover if the farming is intelligently conducted.

The use of plaster and salt when once these lands have been subdued and brought into condition will probably give a new impetus to farming on the plains. Early planting and sowing so that crops may be carried beyond danger of injury from midsummer drought, the compacting of the surface of meadows and sown crops by early use of the roller, and the constant stirring of hoed crops to avoid drying up, are topics that demand attention.

SUBDUE THE LAND.

One of the first conditions of successful farming on the plains is to subdue he land. Because there is no heavy forest to clear off, some seem to think that to roughly plow up the soil is all the preparation required to fit for a crop. This is only to declare hostilities, not to subdue the enemy. When Adam was yet in paradise the first command he received from his Creator was: "Be faithful and multiply, and replenish the earth and subdue it." If the soil of Eden required to be subdued, the wild lands of Michigan will have to stand the same treatment. Subdue your land or your land will subdue you. Plow up the land thoroughly, get out the roots and trash, cultivate and compact your soil by drag and roller, and then you may begin to think about putting in a crop. But if you cannot do this, if you have no team or farm implements, if you have no provision made for your support and living for a year ahead, and only depend upon choking in a crop and skinning the land for your immediate living, then don't attempt farming on the plains.

Dr. Manly Miles of Lansing opened the discussion on Dr. Kedzie's paper in the following remarks:

With this interested audience I need not dwell upon the importance of the problem under discussion.

A happy union of science and practice is necessary for its complete and satisfactory solution, and attention must be given to every detail that can possibly influence the results.

In the able paper we have listened to with so much interest, Dr. Kedzie has given a full discussion of the facts and principles of science relating to the subject, and it remains for us as practical men to devise the ways and means for their application in practice.

Science affirms that the light lands of Crawford county contain all the elements of fertility required for their profitable cultivation, and practically we have to consider the best methods of making them available.

The comparison that has been made between the soils of the plains and the light Campine sands of Belgium, in which the latter appear at a disadvantage, is very suggestive.

My first acquaintance with the plain lands of Northern Michigan was made in 1872 and I was then fully convinced of their agricultural value. A few years later I visited the Campine sands, to which reference has been made, and my observations lead me to believe that in the management of our own light soils we may derive some valuable suggestions from a study of the methods of practice which have produced such wonderful results on these lighter soils of Belgium.

For centuries Flanders has been celebrated for its agriculture, and in the latter part of the sixteenth century, it is said, that Queen Elizabeth sent there for a supply of vegetables, for her table, which could not be obtained in England.

The rude system of agriculture developed in Great Britain under the Roman rule, about the beginning of the Christian era, was practiced with but little improvement until Sir Richard Weston, in 1645, published his work on "Brabant and Flanders and the Wonderful Improvement of Land there," and introduced from Flanders clover and turnips, and thus laid the foundation of the modern system of British farm practice. The most marked effects of these aids to production, in connection with thorough system in management, was shown in the improvement of the light sands of Norfolk through the efforts of Mr. Coke, afterwards Earl of Leicester.

The light lands of Norfolk were but little better than rabbit warrens, worth only one shilling an acre rent, and Mr. Coke, who owned a large tract of these unproductive sands, was compelled to take the management in his own hands.

His success was largely based on the introduction of clover and turnips as staple farm crops, under a rational system of management, and these barren sands were transformed into productive farms that were often referred to as the garden of English agriculture.

It may, in fact, be said that the agriculture of Belgium, with its extensive areas of campine sands, to which Dr. Kedzie has called our attention, has been the means of revolutionizing the agriculture of the world.

The Flemings took a greater interest in the practice of farming than in writing about agriculture, and what we know of their practice is derived from the writings of visitors from other countries. Since the time of Weston, many reports on the farming of Flanders have been published, and from them we learn that the present system of Flemish husbandry is essentially the same as that practiced in the reign of Queen Elizabeth.

Belgium is the most densely populated country in Europe, averaging 461 to the square mile. In East Belgium the population is 120 per square mile; in East Flanders over 700 per square mile, and near Alost, on the border of the Campine sands, the maximum of 800 per square mile is found.

The Campine sands extend throughout the northern part of the kingdom, embracing nearly one-third of its total area. The surface is flat and rises gradually from near the sea level on the west to an elevation of 250 feet in the extreme east.

The surface soil, to a depth of six or seven inches, is a white drifting sand, absolutely barren; below this is a layer of slightly darker sand, seven or eight inches in thickness, and below this is a yellowish sand of somewhat better quality, which is, however, inferior to the soils of Crawford county, Michigan, in chemical composition, so far as the elements of fertility are concerned.

This third or lower stratum of soil is the staple relied upon for ameliorating the surface layers and making them productive.

In the western part of the Campine sands the subdivison of land is carried to about the same extent as in Jersey and Guernsey.

The largest farms contain but about twenty acres, and ten acres will perhaps represent the average, while many are considerably smaller. A farmer renting seven or eight acres may have three or four landlords, and these subdivisions are seldom adjoining.

The competition for the ownership of land is intense and peasant proprietors have invested their surplus earnings in land at the rate of $1,000 per acre.

Rents vary from $5 to $12 and in some localities as high as $15 per acre is paid.

A widow and her three grown sons occupy a farm of ten acres, the live stock consisting of three cows and two pigs, and their net income is over $300 per year. Recently new farm buildings have been erected at a cost of $1,000.

From my personal observations in 1874 and 1880 the most striking features of the general system of farm practice, which must be of interest to all light land farmers, are the prominent attention given to barnyard manures, the thorough system of rotations planned to keep the soil constantly occupied by paying crops, the growing of two crops at the same time, on the same land, which provides for the utilizing of all elements of fertility as soon as they are made available, and the thorough and clean cultivation that is generally practiced.

When one crop was harvested another was put in without any delay. I have seen a man reaping wheat with a sickle, the small bundles were tied up by the children and carried to a hand cart, propelled by a dog and a woman, and hauled to a space near the farm buildings where they were set out to cure; a plow drawn by a pair of cows, followed close to the reaper, and the land was immediately fitted for the following crop.

The greatest care is taken to preserve the barnyard manure without any waste, and with few exceptions it is the only fertilizer used.

Colza or rape is a favorite crop and rape cake is frequently applied directly to the soil as manure instead of using it as cattle food. Middens or manure pits are made of masonry with water tight bottoms and sides, and the barnyards are paved on a slight slope with a gutter and tank to collect the liquids without any waste. Liquid manure is highly prized, and sometimes a spout from the eaves is turned into the midden to increase the supply of manure in the liquid form.

Children may be seen on the highways with a pail and small scoop to gather up the droppings.

When the supply of manure is short the lower stratum of soil is brought to the surface with the spade, used in the bottom of the furrow, but, from the labor involved, this is only practiced at intervals of several years. This secures an improvement of the soil to the depth of 18 or 20 inches and the organic matter of the soil is increased by the accumulated root residue of the crops grown.

There is no fixed system as to kind of crops grown or the order in which they are arranged in rotation. The courses are usually of seven to nine years, and the details are frequently varied.

The leading principles seem to be to grow a variety of crops in such order as will keep the land constantly occupied, and to grow two crops together as often as possible. A few examples will sufficiently illustrate the prevailing practice.

1, potatoes; 2, oats; 3, flax and carrots; 4, rye followed by turnips; 5, potatoes, peas and carrots; 6, oats and spurry; 7, flax and clover; 8, clover; 9, barley followed by turnips.

1, potatoes; 2, wheat and carrots; 3, rye followed by turnips; 4, oats and clover; 5, clover; 6, flax and carrots; 7, rye; 8, buckwheat.

1, potatoes or flax; 2, wheat and clover; 3, clover; 4, wheat and rye; 5, colza followed by turnips; 6, wheat and rye; 7, rye.

On some of the better soils:

1, flax and carrots; 2, wheat; 3, rye followed by turnips; 4, barley followed by turnips; 5, potatoes; 6, wheat and rye; 7, rye followed by turnips; 8, flax and clover; 9, clover.

There seems to be no hesitation in growing several grain crops in succession, when there is a variety of crops in the rotation, but flax is seldom grown oftener than once in five or seven years. Turnips, it will be seen, are often introduced as a catch-crop after a grain crop has been harvested, and the yield is frequently ten tons per acre.

One of the most remarkable features of Flemish farming is the growing of carrots with a crop of flax or wheat, and the mixture of two crops of a similar character, as wheat and rye. The effect of this is undoubtedly to get a greater aggregate yield, although the one may perhaps detract somewhat from the yield of the other. When carrots are grown with flax or wheat, the latter are pulled at harvest, and thus leave the carrots in full possession of the soil.

Wheat with carrots will yield twenty-four bushels per acre, and the carrots with wheat will yield eight tons per acre, or with flax ten tons per acre. The flax being harvested earlier than wheat gives the roots a longer season by themselves.

Most of the sales from the farm are animal products, rape oil, sugar when beets are grown, and wheat. Machinery is but little used on account of the small plots under cultivation, and the low price of labor.

In this densely populated country farm wages are only eighteen cents a day in winter and about twenty-five cents in summer.

The live stock on a farm of ten acres would average two cows, one yearling, one heifer and two pigs. As a horse on a small farm is an expensive luxury, cows are quite generally used to perform the required team work.

On account of differences in climate, markets, value of land and cost of labor, the Belgian system of farming cannot, as a matter of course, be strictly copied in this country, but it is very suggestive in regard to the direction in which efforts may be successfully made in improving the light soils of the plains.

With these preliminary remarks we may now proceed with the discussion of the main question in which we all have a particular interest: What is the best system of farm practice on the light lands of Crawford county?

Greater skill is required for the successful cultivation of light soils than on the average heavy and loamy soils of a more stable composition, and a thorough and consistent system of management must be practiced to secure a reasonable return for the capital invested.

A prescription of any definite routine system of practice will not answer the purpose, as the problems constantly arising are varied by every change of conditions

The soil of the plains, although containing all of the essential elements of fertility, has no surplus wealth to supply the wastes of careless management, and there must be a judicious conservation and active circulation of every element of plant growth to secure the best results in its cultivation.

Science clearly indicates the sources of waste and the causes of failure or success, and the more we learn in regard to the composition of soils and crops and the conditions favorable to active plant growth and development, the wider the range of knowledge and skill required to secure the full benefits of its valuable contributions to farm practice.

Science points out the road to success and we may safely follow its suggestions in devising the best paying methods of cultivation and general management.

We have been told that one of the marked defects of the plain soils is a deficiency in organic matter caused by the fires which have left only the ash residue of previous vegetation.

The obvious remedy for this defect is to grow a variety of crops in regular succession, to make use of every available element of fertility and thus accumulate root residues in the soil as a resource for future production.

A variety of crops of different habits of growth and root development will give a greater aggregate yield than can be obtained, at the same cost, with a single crop frequently repeated.

In the Rothamsted experiments, wheat was grown sixteen years in continuous succession. On another plat wheat was alternated with fallow for sixteen years, and on another wheat and beans were alternately grown for sixteen years. In each of these cases the total amount of wheat produced in the sixteen years of the experiment was practically the same, and the beans were evidently a net gain of produce without diminishing the yield of wheat.

The crop rotations should be planned to keep the soil occupied, without intermission, with growing plants of economic value. The process of nitrification is constantly going on under suitable conditions of temperature and moisture, and the nitrates formed are liable to be wasted by leaching if they are not immediately taken up by the roots of growing plants. Sir John Lawes and Dr. Gilbert claim that the waste of nitrates after a crop of cereals has been harvested is a more important factor in soil exhaustion than the amount of fertilizing constituents removed in the crop.

To fill up the interval between the main crops of a rotation catch or stolen crops should be introduced. Rye or turnips are quite generally grown as catch crops, and on the soils of the plains white mustard and spurry may be mentioned as well worth trying.

White mustard is a quick growing crop on light soils, from four to six weeks only being required for its growth. From seven to twelve pounds of seed per acre is usually sown. It is said to be a valuable feed for sheep, and when fed off, or plowed under, is a good preparation for wheat or other crops. Mr. Curtis, the entomologist, says a crop of mustard will destroy wire worms.

In Essex from thirty to forty bushels per acre of white mustard seed is the usual yield. Black or brown mustard is not grown, as it proves a troublesome weed. In Norfolk wheat following a crop of white mustard yielded from six to eight bushels per acre more than when one-fourth ton of rape cake per acre had been applied as manure. As a green crop after wheat it has been found a good preparation for a spring crop.

In Northamptonshire two or three crops of white mustard are grown in succession, instead of a fallow, and fed off as a preparation for wheat. It is also sown after peas and plowed under as a green manure for the following wheat crop.

Spurry (*Spergula arvensis*) is an annual which grows wild in Great Britain, where it is usually called a weed.

In Belgium, France, Jutland and Russia it is grown as a forage crop and for hay. In France its yield is estimated to be about equal to a crop of clover, or 7,700 pounds per acre. The seeds are fed to cattle and horses, and are thought to be about equal to rape cake in value.

It is a quick and rapid growing crop, which in five or six weeks gains its full height of twelve to fourteen inches, and is said to be a valuable feed for cows, improving the quantity and quality of the butter.

Sown in the middle of April with seed at the rate of fifteen to twenty-four pounds to the acre, it matures the last of May, and a second crop may be grown, maturing in August or September. As a catch crop, after rye or oats, spurry has been grown and fed off and the fertilizing effects were estimated to be equal to from four to six cart-loads of dung per acre. It has been called the "clover of sandy soils."

"Swartz (a high authority on practical agriculture in Germany), in his account of the Belgium husbandry, says: 'Without spurry, the Campine, the best cultivated soil in the world, would have been still a desert. A plant like this, which requires no manure for itself, and which even when mown, by the residue it leaves, gives back more than it takes from the soil—which demands no fixed place in the rotation, but which is satisfied to come in as an after-crop whenever the soil is at liberty—which, except for the seed, requires no preparation; which is satisfied with a soil on which nothing else but rye will grow; which increases the quantity of milk and butter, and improves their quality, and which I am persuaded may be raised with advantage, even on the best soils, provided only they are somewhat light. A proof of this is the land of Waas (Waesland in Flanders), the garden of Europe." (The locality here referred to is between Ghent and Antwerp, or the central area of the Campine sands.)

Von Voght, another acknowledged authority, is quite as enthusiastic in regard to the value of spurry on light, sandy soils. The seed sown in France and Belgium is imported from Russia.

From these statements of the characteristic qualities of spurry, it should certainly have a trial on the plain lands of Northern Michigan.

In planning a system of crops in rotation, provision should be made for an abundant supply of cattle food in sufficient variety, as the elements of fertility can be better economized by making the sales of the farm almost exclusively of animal products.

But a small proportion of the fertilizing constituents of foods are retained by the animal to supply the wants of the system and a large proportion can be returned to the soil to promote future productiveness.

An active circulation of fertilizing materials may thus be kept up, constituting the circulating capital of the farm, and with the least possible waste of the elements of fertility.

A variety of stock, including cattle, sheep, pigs, and poultry, will be found the most economical in the conversion of the crops of the farm into animal products.

Satisfactory results can only be obtained with animals of the best quality or those that give the largest net returns for food consumed. Inferior stock cannot be profitably kept on any farm, but they are greatly at a disadvantage on light soils where the strictest economy of materials must be practiced in every process.

As a general rule the smaller, hardy breeds will give better returns in both quantity and quality of the product.

Farm stock should be looked upon as machines for manufacturing animal products from the crops of the farm, and strict economy demands that large machines should not be used when smaller and less expensive machinery will equally answer the purpose. Among the breeds of cattle the Devons may be mentioned as particularly adapted to the lighter soils. The Red Polled breed, which has not been introduced to any extent in this country, appears to me to be well adapted to the light soils of the plains.

They are without horns, as their name implies, and of bright red color. In size they would be classed with the smaller breeds, and they have the desired qualities of hardiness, early maturity, and ability to thrive on moderate fare. As a dairy breed they have few equals and they fatten readily, furnishing beef of good quality. As a general purpose animal they give promise of usefulness on lands of less than average fertility.

The most economical, and on the whole, the most desirable fertilizer for the plain lands is, in my opinion, barn-yard manure.

It has many advantages over the commercial fertilizers in market, particularly on lands like those under discussion.

Its supply of of organic materials improves the physical condition of the soil, and retains water near the surface where it is needed for plant growth, and thus prevents the loss of fertilizing materials by leaching.

At Rothamsted there was seldom any discharge of water from the tile drain under the barn-yard manure plot, while the drains under the plots that were chemically manured were often running with a decided loss of valuable nitrates.

When live stock is provided to consume the crops grown, the value of the manure supply will depend upon the quality of the food, or in other words, upon the rotation of crops adopted and the purchased supply of feed.

As has been already stated the manure contains a large proportion of the fertilizing constituents of the food consumed.

The following table presents, approximately, the value of the manure produced by one ton of the food enumerated, when fed to average farm stock.

The values are based upon the market price of the essential fertilizing constituents in the form of commercial manures.

Table of Manure Values.

Kind of Feed.	Value of Manure from 1 ton of feed.	Kind of Feed.	Value of Manure from 1 ton of feed.
Corn	$ 6 20	Swedes	$ 1 10
Corn stalks	4 10	Mangels	1 43
Oats	6 62	Fodder corn (green)	1 10
Oat straw	3 00	Clover hay	9 50
Wheat	7 24	Timothy hay	6 25
Wheat straw	2 26	Brewers' grains (fresh)	3 60
Rye	6 70	Brewers' grains (kiln dried)	12 80
Rye straw	2 60	Malt sprouts	16 50
Barley	7 49	Linseed meal (old process)	20 00
Barley straw	2 75	Linseed meal (new process)	22 00
Peas	13 50	Cotton seed meal	28 50
Pea straw	5 00	Middlings	8 90
Beans	15 00	Shorts	10 64
Bean straw	6 00	Wheat bran	12 50
Potatoes	1 68	Buckwheat	6 88
Carrots	0 87	Buckwheat straw	5 00

From this table the relation of the rotation of crops to the manure supply may be readily estimated. A yield of fifty bushels of corn per acre when fed with the stalks would give $18.00 as the value of the manure from one acre. The manure from an acre of clover when fed would be worth $19.00, etc.

These figures must not be taken to represent actual values, which would, of course, vary with the condition of the soils to which the manures are applied. They simply represent the *relative value* of the manures produced from the different feeds as compared with the cost of commercial fertilizers in the market.

Commercial fertilizers cannot be safely recommended as a staple manure supply on the plain lands. It will undoubtedly be better economy to increase the value of the barn-yard manure by purchasing concentrated feeds, like cotton seed meal, linseed meal, malt sprouts and mill feed, which are valuable as foods and likewise, as shown by the table, have a high manurial value. A profit should be made by feeding these articles with the coarser products of the farm, when the manurial value approximates so closely to the original cost.

The plowing under of clover, or catch crops of rye, white mustard or spurry as green manure will undoubtedly, in most cases, prove advantageous from the improved physical condition of the soil aside from the direct fertilizing effect; and it may be the best plan of making a start on land that has not been under cultivation, or which has been badly managed. The practice, however, can only be recommended in exceptional cases, involving as it does a waste of valuable feed for cattle and sheep, as the crops when fed would leave nearly the same value in manurial residue.

From neglect, or lack of knowledge of the real sources of waste, the loss of valuable fertilizing constituents of barn-yard manure, under ordinary systems of management, is enormous, and there is no department of farm economy in greater need of improvement.

(The annual loss from this source in Michigan alone is not less than $15,-000.000.00.)

The liquid and solid excreta, with an abundant supply of litter to absorb all moisture, should be carefully collected and applied to the land before fermentation takes place. When drawn to the field the manure should be spread at once to secure an even distribution over the surface, and it should never be deposited in small piles in the field for several weeks before it is spread, which is a common practice.

On the plains especial attention should be given to the care and application of manure to insure the complete utilization of every element of fertility.

Summer fallows must be avoided, as they are the cause of waste in many directions. The loss of labor, and of the crop which might be grown; the delay in the accumulation of root residues, which is a matter of the first importance, and the leaching of available plant food to the lower strata of the soil, from lack of growing roots to appropriate it as fast as it is liberated, may be enumerated as some of the objections to the practice, without any compensating advantages to recommend it.

The only reasonable excuse for a summer fallow on heavy land is the destruction of weeds, which have been allowed to gain the ascendancy from a lack of thorough tillage and a defective system in cropping.

Weeds should not be allowed to grow on light soils, as they are readily destroyed by cultivation and a system of rotation with catch crops that provide for the continuous occupation of the soil by useful plants. In the struggle for existence the weeds must be crowded out by the dominant vigor of useful plants, and the system of cropping and cultivation must aid nature in providing for the survival of the fittest.

The roller should be freqnently used to keep the soil as compact as possible and improve its physical condition, particularly in its relations to moisture and root development.

Under a judicious system of management, which takes into account provisions for future productiveness, as well as immediate profit, there are good reasons for the belief that the plain lands may not only be successfully cultivated, but made to add to the well deserved reputation of Michigan farms and farming.

RECAPITULATION.

The essential elements of success in the farming of the plains may be summarized as follows:

The leading principle of practice must be to conserve and utilize the elements of fertility in the soil by a succession of crops of different habits of growth and root development, so that the land may be occupied throughout the season with plants of economic value, to prevent any possible waste of available plant food. Catch or stolen crops have an important place in the plan of operations, to fill up the interval between the leading crops of the rotations.

Especial attention should be given to the feeding and manurial value of the crops grown, with reference to their influence on future productiveness, and the roller should be used to improve the physical condition of the soil in its relations to moisture and root development.

The organic matters of the soil should be increased by the accumulation of root residues, the application of barn-yard manure, and, under exceptional conditions, by green manuring.

The value of barn-yard manure depends upon the composition and quality of the crops grown and fed to the live stock of the farm, and the economy practiced in its preservation and application to the soil.

Summer fallows and fall plowing should be avoided, as they involve waste in many directions, without any compensating advantages.

The produce sold from the farm should be largely in the form of animal products, as the manurial residues obtained in their manufacture are important factors in maintaining fertility.

A variety of live stock (cattle, sheep, pigs and poultry) should be kept to secure economy in feeding and the greatest aggregate return for the crops grown.

The sum of the whole matter is, in effect, to see that valuable plants are always ready to appropriate nutritive materials as soon as they are made available by the processes of soil metabolism, which are constantly in progress; to provide animals of good quality to convert these crops into animal products of greater value and the resulting manurial residues which contain the bulk of the valuable constituents, which constitute the floating capital of the farm, must be returned to the soil without loss, to again engage in the cycle of changes involved in profitable production.

In other words, an active circulation of the elements of plant growth and animal nutrition must be kept up to secure profitable production with the least possible waste of raw materials.

Yield of crops of Crawford county compared with other counties of the State for the year 1883. From Report of Michigan Agricultural Statistics, 1884.

Counties.	Wheat, bushels per acre.	Corn, bushels per acre.	Rye, bushels per acre.	Oats, bushels per acre.	Potatoes, bushels per acre.
State	15.12	22	12.5	32.76	68
Clinton	15.26	16	16.5	34	56
Crawford	12.96	5	9	20.18	55
Ingham	17.59	16	16	36.75	63
Oakland	15.51	35	13	40.69	81
St. Joseph	16.51	26	11.5	26.57	86
Van Buren	11.83	18	11	29.79	77

Area of crops in Crawford county in 1883 and 1884. From Report of Michigan Agricultural Statistics, 1884.

Crops.	Acres in 1883.		Acres in 1884.	
Corn		151		186
Wheat	174 Winter 16 Spring	190	436 Winter 42 Spring	478
Oats		206		627
Rye		190		285
Buckwheat		157		275
Clover		242		749
Peas		4		29
Beans		6		39
Potatoes		381		469
Barley		6		16

Dr. Kedzie: A question has been propounded to me: "Can human excretions be used to enrich the soil for the growth of crops?" I say emphatically, yes. One of the abominations of our civilization is the accumulation of such material where it poisons us. It should go into the soil as soon as possible. The soil purifies it and does away with its noxious influence. It is the richest kind of manure.

Mr. Webber: That is the ascension from damnation unto life.

Dr. Kedzie: Very certainly; when it is buried out of sight in the soil and the plant gets hold of it, it is resurrected unto life.

I am asked how the Belgium pea would succeed in this country. I don't know anything about it, but if you can transfer it into American soil it will be a good thing. Peas of any kind are an exceedingly profitable crop as far as the production of manure is concerned.

Mr. ———: How is it about buckwheat?

Dr. Kedzie: I think it is about as low down as you can get. It will kill sorrel and give you pancakes; but so far as enriching the farm is concerned I don't think very much of it. If you can not grow anything else grow rye; that will grow on almost anything and form an accumulation of vegetable matter.

Mr. ———: Must the poor man leave the plains?

Dr. Kedzie: Well, that's not plain. I think that the poor man who has intelligence, pluck, and the faith that subdues kingdoms can stay here and succeed.

Dr. Miles: In regard to buckwheat I will say that they grow it in Belgium; but its value is a matter of contention among farmers. Some won't cultivate it at all. They think it does not work as well in their rotation as other things.

Mr. Silsby: I would like to ask what is the matter with our meadows? On my farm, which was heavy timbered land, the wire worm or something kills the stalk entirely. The stalk grows until it gets to the height of the rest of the grass and then dies and you see the dead stems still standing among the other grass. This is on land that has been seeded for some years and that seems to have become sod bound.

Dr. Kedzie: If you will follow down the stalk you will find there is a little insect that has eaten the stalk off down in the sheath.

Mr. Silsby: What can we use on our sod to destroy that insect; will salt or lime do it?

Dr. Beal: Neither salt nor lime will do any good. Rotation of crops is what you want. If you plow the sod up oftener the worms will not accumulate very much.

Mr. Rose: I wonder if turnips would be a profitable crop to turn in as a green manuring crop instead of clover? They make a heavy growth of tops before bottoming, and do it quickly.

Dr. Kedzie: Green manure is the best if you have not the stock to feed it to, if you can raise crops and turn them under you can raise your land in that way quicker than any other way in the world; but there is more economy in feeding stock and plowing under what they leave and the manure.

Mr. Edmonds: Two years ago I sowed two acres and a half of strap leaved turnips. I couldn't take care of them, but they grew finely, and just before the ground froze up I plowed them under a foot deep. The next crop came up rapidly, a rich, rank, beautiful growth, and was the best where the largest turnips had been. Before spring came there was not a sign of a turnip on the ground.

Mr. Sewell: My practice has been to pull the big turnips for winter feeding of cattle, and pasture the rest with sheep, using hurdle fences. This is the English practice, and is better for the land than any other way of treating the crop. If farmers would do that in this country they would receive the benefit of it; but there are not many of us who are able; we are not forehanded enough. No man ought to come onto the plains without a year's supply, and then it would be a pretty tight nip for him.

President Willits: I have heard it stated that your rainfall here is insufficient or is not well distributed at the time when it is needed the most. How is that?

Mr. Love: During my ten years' residence in Crawford county I have learned that our soil is the best I ever saw for resisting drought, and in that ten years we have had but two droughts. We get very heavy rains generally.

Mr. Lound: During my residence here I never saw the land when the corn would not grow all summer, if it is well cultivated. As dry as it was last summer, and we had no rain from some time in June to the 14th of August, the sweet corn in my garden never rolled at all.

Mr. Evans: I have lived in Clinton and Montcalm counties, and in each have seen worse droughts than during the last five years here. I have not seen any droughts here that the crops would suffer from. Where the land is well cultivated it will hold the moisture better than where it is not. If you dig down on the top of a hill that is cultivated you will find it moist enough for any crops to grow, right alongside of where it is very dry where uncultivated.

Mr. Rose: Last summer I noticed that particularly in my garden. There was no time that I could not with just one scrape of the hoe get moist dirt. Within five or six rods of there I had occasion to dig in the soil where it hadn't been cultivated and I found no signs of moisture for four feet.

Mr. Niles: Reference has been made here to the roller for compacting the soil. The American Agriculturist describes an instrument that I have used for a couple of years past, that can be made very cheaply and quickly and which answers the purpose admirably. It consists of two logs about ten feet long. I like tamarack best. Connect them with pins two inches in diameter about two feet and a half from the ends, so that the logs will lie about two feet apart. Hitch by a chain in the center and drag over the ground as a leveler before sowing crops and follow with the drag. It compacts the soil and levels it at the same time. A heavy 20-foot log chain attached to the ends of the rear log serves admirably to cover clover, turnip, Timothy, or other seed. It moves just enough dirt to cover the seed so that it will come up. You can use a light chain by doubling it. It shakes up the sods so as to take the dirt out of them and leaves the land so level that it is in nice condition for the mower.

Mr. Alexander: There is no lack of rainfall here, as I have observed in driving over this country for the last twelve years. The difficulty is due to drifting sands. The sun shining upon the sand makes it hot, and the winds drift it upon the young clover and other crops and it kills them. I have seen the sand drift in this country like snow three or four feet high. As soon as you get more vegetable matter into the soil, it will stop drifting, and then we will be all right.

Mr. Lounsberry: I have a clay farm, and I have seen my clover in the summer time come up and the sand drift on it sometimes an inch and a half deep from my neighbors' farms, and the young clover be completely covered up. The sand drifts in little waves, as you have noticed the waves on the water, from three to twelve inches wide, and it will huddle around the roots and kill the clover.

Mr. Evans: I would like to ask Dr. Kedzie if there would be any use in covering our farms with muck. In Oscoda county some farms have muck so near them that they could be covered without extraordinary expense.

Dr. Kedzie: Muck is valuable because it contains about two per cent of nitrogen. If you can get that nitrogen into the harness you have something as valuable as the best barn-yard manure. The best way to use it is to compost with barn-yard manure, or to mix marl and muck together, and plow them under. I have seen it tried with good results.

President Willits: You want to be sure it is muck, and not peat. I have seen a good many farmers make the mistake, supposing they were going to accomplish something wonderful by using muck. I think the most available way to use it is to use it with barn-yard manure, making a compost of the two. I have even seen some very happy results from muck alone, not in connection with barn-yard manure at all. I lived for twenty-eight years in Monroe county, and through that county is a strip of light land, about six miles wide. Gradually this strip of land has been occupied by German farmers, who have brought it up to a condition of productiveness by utilizing the pockets of muck which are found in low spots, taking a scraper full of muck from the bed, emptying it onto the field, and taking back a scraper full of sand to put in the hole, and in that way improving both the muck bed and the sandy land.

But after all, their success could be measured by the size of their manure piles. I notice that the successful farmers can almost always be told by the fact that they have a good manure pile, and you find that those Germans have the same faculty of taking care of their manure that they have in Belgium. The best farms to-day in Monroe county are on that same light sandy soil, which, before the Germans took hold of it, was wholly unsalable.

Mr. Love: Does any one know where we can get spurry seed? Some eight or nine years ago I was in a store in Roscommon, and they said they had some spurry seed sent to experiment with on these plains lands. I took a pinch home with me and planted it among some turnips in the corner of a piece of new breaking where there had never been any manure. After a while I noticed there was something green there which grew up rank and rich about a foot high right there in the rutabagas. I let it alone and the next season I found it had increased. It staid in the ground there for a number of years, but finally disappeared.

Dr. Kedzie: President Willits has asked the difference between muck and peat. Muck that is valuable for manure can be crumbled to a powder, and is found on the surface. Below it is a substance that will stick to your fingers like cheese or tar, and yet lower down is a brownish black sphagnum which would never decompose. The substance on top is what you should use. If you take the other material, the tarry material, and leave it on the ground it will dry almost as hard as coal; it will lie there for ten years and be as far as it was at the beginning from decomposition. It is not soft usually unless it is soaking wet.

Mr. Shriver: I would like to ask which would be the best green manure where we can't get clover to start; whether it would be buckwheat or rye?

Dr. Kedzie: I would prefer rye.

Mr. ———: Would you plow in the muck and manure compost in the spring or fall?

Dr. Kedzie: Any time, only be sure to apply it sometime.

President Willits: And mix it up well.

Mr. Rose: I experimented with muck or marl three years ago and four years ago and got the finest results I had on my farm.

Mr. Webber: I would like to ask Dr. Kedzie what would be the effect upon the frostiness of the land of the use of this muck mixed with the sand?

Dr. Kedzie: It would generally make the land less frosty than it would be without it. In the experiment I have carried on for five or six years, testing the temperature three times each day at 7 o'clock in the morning, two o'clock in the afternoon and 9 o'clock at night; the soil was uniformly warmer by two and a half degrees than other pieces right by it without the muck.

Mr. Thurber: I would like to ask Dr. Kedzie how to get rid of sorrel?

Dr. Kedzie: Kill it. Hoe it out. There is no medicine that will kill it. I don't believe clover will touch it. So far as I can see the only way is to procure the growth of something else that will crowd out the sorrel.

Mr. ——: I want to know if our tamarack and cedar swamps will produce valuable muck?

Dr. Kedzie: Certainly. Almost any swamp or beaver pond will furnish it; any place where vegetable matter has partially decomposed under water. The value for manure is about the same wherever it is formed. Even substances that are not particularly rich in nitrogen when they are partially decomposed become effective from having the nitrogen that is in them brought into available condition.

What is the sense in buying commercial fertilizers if you have these natural nitrogen banks of deposit ready to your hand?

President Willits: What would you say of the practice of burning off a swamp in order to cultivate it?

Dr. Kedzie: You might as well burn down your barn in order to sell the ashes.

Mr. Bradley: Is marl best from the surface or from beneath the surface?

Dr. Kedzie: There is no difference.

Evening Session.

The last session of the institute was graced with a larger attendance of ladies than any of the previous sessions, and was opened with a song by the Glee Club, "Leaf by leaf the roses fall," followed by a recitation by Miss Carson.

Prof. McLouth was then introduced and spoke as follows on

INDUSTRIAL EDUCATION.

Mr. President, Ladies and Gentlemen: I have been listening with a good deal of interest, with more interest perhaps than most hearers, unless it be those who are actually engaged in the work of reducing these lands, to the discussions as to how you may improve your lands, your stock, and your crops, how you may make two blades of grass to grow where but one grew before, and I feel a good deal of embarrassment in introducing a topic so foreign to the main thought of the institute—that of material prosperity and the making of homes. This is a proper subject. We must be housed and fed before we can do higher work. It is said to be useless to preach to a hungry heathen. He must first be fed, and so it is with us.

But I shall claim but a short portion of your time, and yield the floor to those who will discuss a possibly more congenial subject.

And yet in all your suggestions as to the products of the farm you have made but one reference to one of your products which is perhaps the best of all—the baby.

The men and the women raised on the farms are their best productions, and these can be produced on other than the best of soils—on the bare soils of New England they have raised the very pride of the country. Fertilizers are not needed to produce these best products, and they are worth more than all your big pumpkins.

My theme is in the line of the education of these products of the country—the industrial education of young men and women. What is it? It is that training which prepares a man specifically for the pursuit which he is to follow—though as commonly meant it is for manual occupations only. It is a school where young men and, in a few cases, young women are trained to be farmers, mechanics, or whatever other manual pursuit they may choose to follow. Happily for mankind most of us must choose some such occupation. Is there any absurdity in a training for such a life? Is it absurd that while the State teaches the lawyers and the doctors it shall also teach the farmers? Are the lawyers and the doctors worth so much more to the State that she should care for them more carefully?

Schools were first established during the age when the people were divided into aristocracy and commonalty, and as a result education was planned to develop the learned few who were to spend their lives in literary ease, while the toilers were left to themselves. We have been like the man who is said to have begun his chimney at the top.

We have framed our systems as if our young people were to be principally public speakers, instead of filling the many different places in life.

The theory of industrial education is that it shall be so planned as to best prepare the pupil to follow those pursuits which he will afterwards choose. The object of education is said to be two-fold: 1st, to bring out or develop power; 2d, to produce skill. These objects are quite different. A person may have powerful muscles but be without skill to use them. If he should try to row a boat or to swing a scythe he would fail.

Now some adherents of the old school say we must have one kind of school to give power and another to give skill. While we say that the training for skill will develop power; we believe it is not necessary to learn one thing for discipline and another for skill. Many people are very fearful of the phrase utilitarian. What is its meaning? Something that is useful. A philosopher of ancient times defined a philosopher as one who scorned to do or learn anything useful.

I heard a few years ago an eloquent appeal against utilitarianism. The speaker was a bishop, and he was born to wealth and ease. He could not understand the hard struggle of life. I believe that education to be best which is most truly utilitarian.

I advocate industrial education for many reasons. We need in this country skilled hand workers. I traveled over Michigan last year and was astonished to find that not one in ten of the foremen in our shops are Americans. They are nearly all foreigners whom we have had to import to carry on our industrial enterprises, because in Europe they have long had this industrial training. If we had more of it we should have fewer tramps and fewer anarchists. We need this industrial education to teach the dignity of labor—to teach that labor should be intelligent and held in honor. There is no dignity in mere brute labor; it is only as it is directed by intelligence and skill that it becomes worthy of honor.

This will result in making labor more congenial and agreeable, so that we will be less troubled with our sons hankering to measure tape or run into some town office.

One more point. Thus far we have tried industrial training for our boys only. Just in the same way a couple of centuries ago *all* education was confined to men, and it is only comparatively lately that it got thro' the thick skull of the race that education was a good thing for women, and it seems to me that every argument that applies to industrial training for young men applies with equal force to extending the same advantages to women.

What is there now open for a young woman to do? She may teach. True, but that one profession is so crowded by young women that wages for them have sunk to starvation rates.

Or they may marry for a living. Now, I have three girls, and I hope that I may be able so to educate them that they shall not be *compelled* to marry for a living.

Recently I visited some institutions where this work is being done, and will mention one—the Kansas Agricultural College—an offshoot, we may almost say, of our own Agricultural College.

Nearly half their students are young ladies, daughters of farmers and of city men, and they are taught practically such things as are by common consent held to be women's work.

They go to the kitchen for their industrial training, and I can tell you it is a most interesting sight. They go by sections. A woman was in charge, and she seemed specially well qualified for the work, full of zeal and skill and good humor. The girls came in in white aprons, with sleeves rolled up, and they made bread and cooked meats, and practiced setting the table, and all such elements of home comfort.

Another section were practicing on dressmaking.

Do they ever object? Occasionally, but they soon become absorbed in the current and take pride and pleasure in their work.

They may learn telegraphy, type setting, photography, type writing, typography, wood carving, etc., etc.

We have as yet nothing of this kind in Michigan, but I hope before I am many years older that we may see even this among us. What is the justice in doing so much for our boys and leaving our girls to shift for themselves? Ladies, when you go home think this matter over and tell your husbands how to vote on the subject.

Hon. Wm. L. Webber, of East Saginaw, was introduced and spoke further, as follows, on the same subject of

INDUSTRIAL EDUCATION.

Mr. President, Ladies and Gentlemen—One of the things that a lawyer learns early is that words should be used to express ideas with exactness. Prof. McLouth expresses his ideas with exactness as a rule, but I think he made a mistake when he said that one of the objects of industrial education was to dignify labor. Let me put it as it seems to me he meant it: "One of the objects of industrial education is to teach people to properly appreciate the dignity of labor." You see the difference between the expressions. Labor needs no dignifying; all it needs is to have people educated so that they will correctly appreciate the true dignity of labor. No man ever yet lived but "should have died in the borning" who was not a laboring man, one who would appreciate the dignity of labor if he were correctly educated; for we are so formed that "we are all members one of another."

Society is made up of the brotherhood and sisterhood of human beings, and any man living in society who is not willing to try to make others wiser and happier, is wasting his time, doing nobody any good, nor making himself happy. A man who strives to make others happy and succeeds, thereby best insures his own happiness.

It was said by a poet many years ago:

> "Honor and fame from no condition rise;
> Act well your part—there all the honor lies."

Honor is not conferred upon an individual unless he himself is honorable. You may send a man to Congress if you please, but unless that man acts well his part when he gets there, you have only made his failure more conspicuous; you have conferred upon him no favor; the position gives him no honor. It is only his conduct when he is placed in position that gives him or entitles him to honor.

Our system of education, as provided by the laws of Michigan, furnishes every child an opportunity to acquire a certain amount of learning. A long time ago the idea became prevalent that there must be no sectarianism taught in schools. The idea in practice has gone beyond what was intended. It has gone so far that it has even left all good morals out of our system of education. Now, there are certain principles of human conduct that underlie every man's actions, principles which all good men agree are right, principles that may be safely taught, even though it may not be purely intellectual education. Go through our schools, listen to the addresses delivered at the gatherings of our educators during the educational conventions, and you hear little spoken of except pure intellectual development. Knowledge is power, but the devil has a great deal of knowledge. If you give a bad man knowledge you make him powerful for evil. You must give a direction to power or that power had better not exist. If you give a proper direction to that intellectual development you have thereby benefited those who are intellectually developed, and by benefiting the individual you have benefited everybody with whom that individual comes in contact through life; but if you give a person intellectual development without giving it a proper direction he is just as likely, perhaps, to go wrong as to go right, and that is one of the troubles of the times. I say our common schools are defective in that they fail to teach good morals as much as they should. Perhaps I might go further. The primary place for all education is at home. Every father and every mother should be careful to see not only that their children are properly developed intellectually, but that that intellectual development has a direction given to it which shall make them better and wiser, and make the world wiser because they have lived in it.

I agree with Prof. McLouth, in his definition of education. As he gave it it is not a very common one but it is a very excellent one: "Education is that training which best fits an individual to fill his station in life with credit to himself and with profit to the community in which he is called upon to live."

Industrial education is that which enables us to do what we have to do with less cost to ourselves—cost in the way of physical labor, in the way of time, etc. It has long been my opinion, and I think you will generally agree with me, that among the farmers throughout the country one-half of their physical labor is actually wasted for want of proper direction and for want of not being done at the proper time. One of the most difficult things to do with men that I have had to work for me upon the farm is to make them believe and appreciate that they could kill twenty weeds one inch high just as easy, and, in fact easier, than you can kill one weed twenty inches high. If, when those weeds are just showing themselves above ground, there is to be a circus somewhere, and you let the weeds go, the first you know, the weeds are so high you must give more than double the labor you would have required if the work had been done at just the right time. If farmers will do their work at the right time they will get better results with the same amount of physical labor.

In regard to industrial education as a specialty, I think it would be an excellent thing for the State if it had more attention; if our primary schools, as they are called by the statutes, instead of developing into universities in every considerable village or city throughout the country, each had its branch of manual labor connected with it. If I had the power to make a law for the University of Michigan I would enact that every student in the University should devote at least three hours a day to some mechanical manual labor.

I will tell you why I should do it. I would do it because it is better for the young men. One of the very first things a young man ought to learn—I say young *men* particularly—is how to get a living. Prof. McLouth thinks a young woman ought to know how to get a living too in order that she may take care of herself, but I am inclined to think if the young men all know how to get a living the young women can perhaps "jump on to the bicycle;" but you cannot make a nation such as this country ought to be unless every man feels within himself the consciousness that he is able to take care of himself. You must give him that sort of independence which I am happy to say is so common among the farmers of this country, more so among the farmers than among any other class of the community. As long as he can take care of himself he is a true, independent American citizen, as a free man ought to be.

But if he feels that he is dependent upon somebody who knows more about the proper thing to do than he does, somebody he has to look to for his support, he ceases to be an independent American citizen, because he feels his dependence, and as long as he feels that he can not act as though he didn't feel it; it is not human nature.

Farming on the plains is a subject to which I have given a good deal of thought and observation for some years. More than 15 years ago I was land commissioner of the Flint & Pere Marquette railroad, looking after its land grants and the value of its lands. Some of our land is very much of the character of the plains here, but from what I have learned here I think your have more clay in your plains than we have. You are higher above the lakes. Those plains will run from 100 to 150 feet above Lake Michigan, which is substantially the same level with Lake Huron. These plains are from 500 to 600 feet above the lakes, though perhaps some of them further south in Iosco county are lower.

There is no trouble in getting water, and the first question that arose in my mind concerning the plains was, will they leach? If manure is applied to these lands will the rains that fall upon this manure wash out the soluble portion of it and carry it down so deep that plant roots cannot find it? That was the first question. Dr. Miles told you to-day that his attention was first called to these plains in 1872. I happened to be with him on that occasion. We were in Lake county. We had had a hard day's tramp of about 25 miles—this was before the railroad—and on the bank of one of those beautiful little lakes which abound in Lake county, the number of which give it its name, we made our camp. One of our objects was to learn something about the soil of the plains. While our camp was being put up we took a water pail, Dr. Miles and I, and went down to the bank of the little lake and he selected a piece of ground as a specimen of the plains, and with his hands scooped out a little place perhaps six inches deep, taking all the soil there was in that six inches, and measured it in a pint cup we had with us to drink from, and put it in the pail, and he had two quarts of this earth; then he dipped up some water from the lake and poured it into the pail until he got the pail pretty near full of water and stirred it up. The water dissolved all there was in it that would dissolve. He then turned off the soluble portion, leaving that which would not dissolve in the bottom of the pail. He washed it again and again as long as the water would pour off roily. When he got through with that he put the sand back again into the cup and he had only three cups full; the fourth one had dissolved in the water and had been turned out. He turned to me and says: "That land will not leach; here's an abundance of soluble matter right on the surface, and if this land would leach that soluble matter would have been carried down out of sight long ago." What a simple experiment. Still it was absolutely demonstrative.

Ever since that night I have had faith in the plains, but I have had to hope against the experience of a great many failures. A great many men have gone on them to make homes and have gone through with their little means and deserted them.

I never felt more sorry for a man in my life than I did for one poor fellow I met. I say I met him. I came to where he had just built his homestead buildings upon the plains, and he was at work in his front yard with a spade digging up a little patch of ground where he proposed to plant a few potatoes. I said to him: "Have you a team?" "No." "Have you a cow?" "No." "What have you been doing heretofore?" He says, "I've been sailing." "Were you ever upon a farm before?" "No." That poor man, without any experience, without any education—as I might say—to fit him for the plains, had gone there without any money, without a team—but he had a wife and baby, and he occasionally worked out in some lumber camp in the neighborhood and got a little flour; and he was trying to make a home for himself. I sympathized with him, but really I expected he would fail. A man can't help failing when he goes into a business that he don't know anything about. In order to succeed upon the plains a man wants a good industrial education; he not only wants to be industrious, but he wants to know how to apply his industry so as to get practical results.

The fire is the greatest enemy of the plains. Year after year it has swept over them until everything that is vegetable on the surface has been burned away. You cannot get any good results until you put that vegetable matter back again. But how best to do it is the question. You must study for yourselves how best to do it it in your particular circumstances. If you are situated so that you can get barn-yard manure, put it on; if you are so situated that you can get muck, put it on; if you are situated so that you can't get either, you have got to do it with green manuring. You can't buy manure to put on there. You may have your pockets full of money and you would fail before you got through. By green manuring, sowing crops there which will grow and not taking them off, you will get along all right.

Some men meet me with this: They say, "We can't leave a crop on the land; we have got to live; we have got to have what comes off the land for the first crop." Suppose that is so. It don't take long to clear an acre of plains, and if a man has a team so that he can plow up his acre or his two acres that he wants for his crops, let him do it; then let him plow ten acres more and put that into something which he proposes to turn under and let him turn that ten acres under, and let him turn it under for three years in succession, if you please, while he is living off the two acres or what he needs to live on; then he will get something that will pay for his labor.

You must put that vegetable matter back into the soil; it won't be put back for you, and until you put it back either by green manuring—which in my judgment is the best solution of the whole problem except where you can get this muck handy—you can't take off vegetable matter.

Mr. President, I believe I have fulfilled my mission. I thank you, ladies and gentlemen, for your attention.

The following paper was then presented:

AN EXPERIENCE.

BY HON. O. PALMER.

In 1879, knowing something of the physical geography of Michigan, I came to this section to escape the effects of "hay fever," from which I was an extreme sufferer. The altitude, about six hundred feet above the lakes, promised immunity from malaria, and the promise is fulfilled, as I have never known an instance of malarial disease originating here.

I came filled with the common prejudice against the place on account of the climate and the supposed barren soil. I met gentlemen of culture and business experience who attempted to combat my ideas of the utter worthlessness of the country, save for pine logs and the pleasures of hunting and fishing. I listened as patiently as I could, as an unbeliever, thinking only that they had land to sell. Tiring of the confinement in this then shanty village, I made inquiries of where there were settlers and began visiting the farmers' homes. In most cases I found poverty; not one in ten owning a team, but all doing something in agriculture with such means as they had. I compared results with those I was accustomed to in the old well tilled portions of the State, and with the approach of cold weather returned home with my heart filled with pity for the unfortunate beings who had been beguiled with the hope of making a home in this, to me, worse than desert.

The next season my old enemy drove me here again, and I visited the same homes and many new ones, and found, much to my surprise, improvement everywhere. Small fields of clover were proving that clover could be grown. Oats, rye and barley promised well, and I had never seen such vegetable growth as I found on every hand. An accident made me owner of a quarter section of the plains, and I determined to experiment. My experience is the same as of most settlers,—not knowing how to handle the soil, or what to raise,—but after six years I find on the land I deemed most barren clover that cuts from one and a half to two and a half tons of cured hay per acre; wheat, of extra quality, yielding from eight to twenty-five bushels per acre; oats, twenty to forty-five bushels; corn, sixty to one hundred bushels of ears, though corn is uncertain yet on account of the early and late frosts common to new countries; and vegetables and small fruits unexcelled anywhere either in quality or quantity. I believe that fire has been the only bane; its annual visitations having burned the vegetable mold from the soil, and if that be returned by proper cultivation we shall have the "Garden of Michigan" on the quick soil of the "barrens," where we now have the greatest natural beauty, the purest air and water and the most healthful portion of the State.

REMARKS BY PRESIDENT WILLITS.

I have been asked to speak of the relationship of the Agricultural College to experimental work.

When I went to that institution I found its principal endowment to consist in a land grant from the United States government, the purpose of which was primarily educational, and only incidentally experimental.

The College now receives from this source about $30,000 per year, and this is almost wholly expended in the work of education.

The College was founded in 1855, when little was thought about experimenting in this country, though the present impetus had already gained some headway in Europe.

But times have changed and we have been compelled to change with them. We have at length found out that the virgin strength of our soils was not exhaustless, and our failing crops admonish us of the necessity of altering our practice. Entire sections of our country have been abandoned for agricultural uses because of the infertility of the soil, and we are brought to face the fact that something must be done. We have had to study this problem, to experiment upon it, to seek out the causes, and the means of avoiding them, and finally to devise means to restore these ruined lands.

It is the duty of the State, if it be a possibility, to provide the ways and means to preserve its domain from deterioration and to utilize its apparently waste places.

Thus it seemed to me on entering upon my work at Lansing that the College had a double mission—not only to educate, but to go forth and seek out and experiment upon and try to solve the problems that press upon the community.

Now the question arises, how is this to be accomplished? Our previous work of education, as already stated, practically requires all of our present resources, and we have been compelled to look for future aid to enable us to undertake this new field of work. We have looked to Congress, and the Hatch agricultural experiment bill, now before that body, will, if it becomes a law, provide for each State, having an agricultural college, $15,000 a year for experimenting. The only restriction as to the method of expending this amount is a provision that not more than one-fifth of the first year's appropriation nor more than one-twentieth of the appropriation for subsequent years can be devoted to buildings.

If this law becomes effective, we will not need to apply to the State Legislature for help in this direction. If the law passes, it will be my desire to devote a portion of it to an effort right here in your midst to work out a satisfactory solution of this problem of the plains. We want to find the grasses suited to your uses; we want to find or develop, if they do not yet exist, fruits that will perfect themselves here and be perfectly hardy. We want to try the virtues of spurry and of different rotations, and in every way to test the agricultural possibilities of this region.

MARKET GARDENS ON LONG ISLAND.

Mr. Webber: When on my feet before, I intended to speak of the market gardens on Long Island near New York. Many of these are on land as light and sandy as any that you ever saw, and yet by manuring they produce wonderful results. One such piece of land had been abandoned as worthless and left to common till finally a Dutchman offered to buy it, provided he could do so entirely on credit. In an astonishingly short time he had the place paid for and in good shape. Some one asked him how he had been able to get anything out of that soil. He said he did not take anything out of the soil. All that he wanted of the soil was that it should "hold my vegetable while I feed him"—with manure.

The various committee reports were then presented and acted upon, the principal resolutions being in favor of the passage of the Hatch bill, after which the institute was closed.

MISCELLANEOUS PAPERS PRESENTED AT INSTITUTES AND ELSEWHERE.

HIGHWAYS—THEIR CONSTRUCTION AND MAINTENANCE.

BY A. L. DREW.

[Read at the Three Oaks Institute.]

This country, with all its power and wealth, may look with envy upon the highways of ancient Greece and Rome, and learn with profit that the improvement of their roads marked an important era in the history of their wealth and military power. Common roads are to the people what the blood is to the human system, a necessity, and should have the same consideration, if we hope to maintain a healthy condition.

How ready is the progressive farmer to avail himself of all the improved machinery, that he may be enabled to cultivate his lands profitably! Yet how slow are we to avail ourselves of improved implements for and methods of constructing our highways. Well do I remember the manner and methods of accomplishing this work in use forty years ago.

Let the pioneers of this country go back in memory with me, if you please, to those days when you were making the first effort to develop this country by road making and take an inventory of the outfit. Of what did it consist? of the same kind of tools that are in use at this day. Gentlemen, are we following the spirit of the times, when, at this era of mechanical ingenuity, we satisfy ourselves with the same kind of appliances in the construction of roads that were in use fifty years ago?

With the permission of this meeting I will mark out a few things essential to good results in the construction of our common roads.

ALIGNMENT.

First, alignment: This is the very first thing in the construction of a road; and if this has not been attended to, although the road has been improved for twenty years, let it be done now, or before any more work is put upon it. I have in mind numerous instances where the highway has been laid, and recorded on a section line, and the work of construction entered into, without the aid of a surveyor, for the sake of saving four or five dollars, where large sums of money have been expended by commissioners, in grading hills and turnpikes, which are entirely outside the right of way, and a total loss to the community, and an injury to the owner of the adjoining lands. This is no uncommon thing. Let me instance one case which has given me much annoyance, and will as long as I live if the matter is not corrected. The highway leading north from Three Oaks has been turnpiked and graveled at great expense, and when completed they find the center of the road is the center of the ditch on the west side.

The rural districts are not the only localities that suffer from this evil. Look at the streets of some of your cities and villages and the evil may be found there to an alarming extent. In this beautiful village of Three Oaks there is not a single street where the grade has been constructed on the center line. Even Elm and Main streets have been constructed without any apparent desire to have the grade on center line of street. How long will this waste of time and money continue? Until the public take the same interest in their streets and highways that they do in their farms or manufactories.

Upon the subject of alignment I can not be too particular. The commissioners should order out a competent surveyor, and set land-marks in the center line of road, and on the boundary lines where they will not be disturbed, and can be found for reference at any time, and then in turnpiking the road, line stakes can be set from the center marks—if not disturbed—and if they are, then by measurement from the ones on the outer line, and the pike built to this line.

It may be urged by some that surveyors differ so much that when the work is done we know no more about the location of the line than we did before. We say, employ a surveyor who is financially responsible, and the courts will hold him liable for all damages sustained by the township, in consequence of his blunders. [Com. of Highways *vs.* Beebe, Mich. Sup. Court]

WIDTH OF TRACK.

The next thing to be considered is the width of the roadway, which in this State is fixed by statute at 66 feet in the clear. But the width of that portion for travel is left to be determined by other considerations. For the drive-way of our most frequented roads—except near large cities or villages where there is much pleasure driving and broad roads are desirable—a width of twenty-five to thirty feet will be found ample. For cross-roads and those of less importance, a drive-way of from sixteen to twenty feet will be found sufficient. All unnecessary width should be avoided, as it will increase the cost of construction and repair. The highways of Europe, and the older portions of our own country, seldom exceed twenty feet in width on the carriage drive. Macadamized roads very seldom have this width; and the old Roman roads were very much narrower, seldom exceeding twelve feet on straight lines where extensively used.

SHAPE.

The shape of the road when completed is a subject too often over-looked by road makers, wide roads being left too flat to promptly turn the water into ditches, and narrow ones too crowning for convenience and safety of travel. The surface of all roads on heavy soil should be sufficiently convex to readily turn off all the water before it has time to soak through the surface. The shape I would suggest for the surface of the road would be to have the centre the highest point and slope both ways to the side drains, with a drive-way on each side of the center for convenience of travel, benefit to the roadway, and ease of repairing; it being much easier to run your road grader or leveler over the traveled portion when one side of the center, for two reasons: first, you have less distance to move the earth necessary for repairs, and second, having two drive-ways neither are so apt to be cut up, the travel being divided.

DRAINAGE.

In forming a road bed in heavy soil or in flat lands, the all important question to be considered is the provision for thorough drainage; without which we need look for no encouraging results. But with such drains good roads can be made on any of our lands of this character. I would much prefer to attempt to make a good road on these soils than upon the sandy lands of our county. These sandy lands baffle my skill in engineering so far as applied to the construction of our common roads. But upon the heavy soils and on flat lands good and sufficient side drains should be constructed on each side of the passage way, and cut to a grade so as to be at least two and one-half feet below the lowest portion of the road bed and of sufficient size to conduct the water from the adjoining lands as well as from the road surface. The larger drain should be constructed on the upper side of the road and should have an even and constant descent to some natural or constructed water conrse. As a superabundance of water is the most persistent foe of good roads, the roadmaster or overseer will make it his first and paramount duty to totally rout and drive it from the field and road side, leaving no lurking place for stagnant pools. While so much for the good of our common roads may be accomplished by this thorough system of drainage, we should in every other way assist nature to assist us. This may be done in discouraging the planting of shade trees, as is now provided for by statute along the border of our common roads, which will in time obstruct the rays of the sun and a free circulation of the wind, which is very essential to the maintaining of good roads on these heavy soils. A few trees may be permited, but they should be eight or ten rods apart on this kind of soil.

SANDY ROADS.

The same rules will apply in their construction, save perhaps that where clay can be had by carting two or three miles, one track on the right hand side of the alignment of the road leading to the market place could be covered with clay to the depth of six or eight inches, and held in place by the piking of sand. And on this kind of soil you may plant all the shade trees you please with good results, as the sand, if kept moist, is better adapted to good roads than when dry. In this class of roads I would recommend that the shade trees be planted upon the alignment of the road and the drive-way on each side, with a foot path on the alignment.

GRADE.

It is well known that a team will draw no more produce to market than they will draw up the steepest hill on the route. Therefore the grade of the road enters materially into its usefulness as a channel of commerce to a people. It has been said that the grade of a road should never be so steep that a carriage would descend by its own weight on a moderately good surface. This rule, according to experiments made, has been found to be one foot rise in thirty to thirty-five feet horizontally. In a less perfect condition it would range from one foot in twenty to one in thirty. But one foot rise in sixteen ought to satisfy this and the coming generations of people, and all our work should be done with this object in view, especially on our much traveled highways.

BRIDGES, ETC.

Whenever a bridge or culvert is put in let it be of such material and construction that when once completed it will require no further attention. This may be done in small culverts by the use of sewer pipe of sufficient size; and where there is a large flow of water at times, I would spring an arch of stone or hard burned bricks of sufficient dimensions to insure a free passage. When this is once properly done it is forever done, as no planking is decaying or wearing out.

LAWS.

I would suggest the following changes in our road laws for your consideration:

First—Let us change the manner of electing our overseers, and elect them in the same manner in which we elect our township officers—by ballot—and then we will get better men for the work to which they are assigned.

Second—Make the commissioner of highways the custodian of all the roads in the township, and all the pathmasters his aides and subject to his direction.

Third—Make it the duty of the commissioner to lay out and plan for each pathmaster the work to be done in his district and to give it his personal attention.

Fourth—Give the commissioner of highways authority, and make it his duty to keep the highways of his township in repair, with full power to provide by tax the necessary funds to meet his expenses.

Fifth—Make the highway labor tax assessed subject to the order of the commissioner of highways upon twenty-four hours' notice.

Sixth—Make ten hours a legal day's work upon the highways.

Seventh—Make it the duty of every town to purchase one or more of the improved road grading and leveling machines, and place them in the charge of the commissioner of highways to be used by his aides in the turnpiking and leveling of the carriage ways.

Eighth—Amend the law so as to have our roads put in order as soon as absence of frost permits in the spring, and receive constant attention from that time until prevented by the frost in the fall.

Mr. ———: How would you protect shade trees if planted in the center of the road?

Mr. Drew: In the same way as at present—by law.

Senator Sherwood: It strikes me that a more economical method of making and repairing our roads is to have it all done by contract as in other public work, and to levy all road taxes just as other taxes are levied—in cash.

Mr. Perry Fox: I would have a law to hang every man who worked a day on the roads after the first of August.

UNDERDRAINING.

BY A. E. UPTON.

[Read at the Fremont Institute, Feb. 4, '87.]

Suppose a field of twenty acres, with an irregular shaped piece in the center of four acres, filled with the usual brush, logs, grass and small trees. This can be cleared and worked to a certain extent by the use of an open ditch; but the continual turning around of the team as you come to the ditch, which is almost sure to be cornerwise of the field and usually more or less filled up when wanted most, makes it only a partial relief or substitute for a drain. The fact that you can drive entirely across an underdrained field and have the benefit of the whole of it, instead of wearing out the high land, while the low land (which is the best for many purposes) remains entirely unused, commends the use of drain tile to observing minds. When Northern Ohio, Indiana and Southern Michigan were being settled the decaying vegetable matter produced fever and ague. With the clearing and draining of those States this disease and many of similar nature have almost entirely disappeared.

Some of our legislators have thought that, in the matter of health alone, it would pay the State to drain its low ground. Our cellars being lower than the surrounding vicinity, should be provided with an under drain, otherwise poisonous gases will arise and foul the air breathed by the dwellers above. The fact that a piece of ground that is under drained can stand the drought better than a piece that is not, is a surprise to many. A deep sandy soil or a clay loam soil, with a stratum of gravel, lying from two to five feet below, do not need under draining.

But all our swamps, marshes, creek and river bottoms, where clay predominates, or in fact any places where water will stand long enough to interfere with cultivation or the growth of crops, need underdraining. The proper depth for laying tile is below frost line.

Tile are faithful servants; they beat the Yankee's honey bees that worked Fourth of July and Sundays; they work night and day the year round, if not prevented by dry weather, and then they are open for a job.

The question arises, Can underdraining be over done, since in an ordinary alluvial soil the water after a common rain, if tile are properly laid, finds its way to them in two hours, could the rainfall of a county be in this way too suddenly disposed of? The Creator, in the formation of the earth, placed upon its surface lakes, ponds, marshes, creeks and rivers without number. This, undoubtedly, was for a purpose. All the minute channels of water coursing through the earth are fed from these sources, and they in turn supply the continuing needs of animal and vegetable life.

If, for instance, the St. Lawrence basin were thoroughly tile drained, the water after a storm would quickly find its way to the ocean, leaving nothing to supply the natural wants of the earth. Would not this have the effect in time of making a Sahara of our portion of the earth? Or is it possible that a system of cut-offs and storage reservoirs to hold the water at certain portions of the year, would restore the natural order of things?

After finishing the above paper, Mr. Upton stated that within the past year he had put in a mile of tile drain, and that he intended to put in another mile during the coming year. He also exhibited samples of draining tools, and of tile of various sizes and qualities, overburned, underburned, cracked and glazed.

Mr. Hilton: In digging in this country no single kind of soil is continuous. Now, how can you keep tile passing from sand to clay or clay to sand from breaking level ?

Mr. Upton: In such cases I lay a strip of board to put the tile on.

Mr. McCallum: Gravel will serve even a better purpose than a board, as it is a protection against quicksand and will not decay.

Dr. Kedzie: One advantage of draining, which has not been mentioned, is the saving of warmth to the soil by obviating the need of evaporating the entire rainfall, and thus saving all the heat required for that operation.

A three-quarter inch pipe two-thirds full will, in six months, carry away water which it would take the heat of seventy tons of coal to evaporate.

A difficulty in the way is the occasional obstruction of the tile in draining swamps, where the water is impregnated with oxide of iron, which deposits and fills the tile. Sometimes it is necessary to take up the tile. The plan has been tried of attaching a swab to a wire rope.

Swamps are sometimes drained by driving holes down to a gravel layer.

Prof. Johnson: In laying tile through muck and quicksand we have not found the use of boards advantageous, as they decay unevenly. Gravel is much better. In laying through quicksand the digging is often extremely difficult. We use a sheet iron U shaped curbing, two feet long, which holds up the earth on either side as we lay the tile. We push the curbing along ahead of us with the open side toward the tile. We have found a difference of six degrees in temperature between drained and undrained land. Animals have better health on drained lands. We have lands that were formerly covered with water, and which, with no other treatment than drainage, have become our best pastures.

Three feet is deep enough to lay tile to escape frost, though, of course, the deeper the tile the fewer lines will be necessary, but the expense of going deep is greater than of making more frequent shallow drains.

It is generally agreed now that it is better to lay lines of tile up and down rather than across a slope. I would use nothing smaller than a three-inch tile anywhere. We want capacity enough to get rid of water as soon as possible. Also, large tile obstruct less easily.

Mr. Upton: Indiana engineers say that a tile will drain a number of acres equal to the square of the inside diameter of the tile.

Mrs. Hall: Often in digging wells you strike quicksand against which you cannot curb. Would gravel hold the quicksand in the well?

Mr. McCallum: I drove a two-inch drive well 25 feet into quicksand—used a very fine sieve for the point of my well, and it works all right. I paid $7.00 for the right screen.

Dr. Kedzie: There is no difficulty in driving beyond quicksand till you find good gravel.

Pres. Willits: Nothing has been said of the outlet for these tile drains.

By careful study of the lay of your land you can save a great deal in your system of tile drains.

I bought a farm that had five acres of quicksand that I found had a clay rim. I tried to drain the hill and had no success until I cut through that clay rim in five places, and that let the water right out, and so by an expenditure of $25.00 I drained the whole five acres.

After all, the matter of first consideration is to be certain of the grade of your drain.

Not the least advantage of draining is that it enables you to get at your land from a fortnight to six weeks earlier in the spring.

Mr. McIntyre: Does it pay to drain land on which there is ordinarily no surface water?

T. H. Stuart: I remember a high lying farm where there was no standing water and which was called a dry farm. The owner thoroughly underdrained his land and said he never spent money to better advantage.

H. G. Reynolds: Many lands are naturally underdrained, and it would be a sheer waste to underdrain them.

Dr. W. J. Beal: A good test is to dig holes two or three feet deep and see whether they gather standing water. If they do the land needs draining.

T. H. Stuart: In the farm of which I spoke, the owner, wherever his drains came shallow, brought them to the surface in open troughs for watering his stock, and these places never froze in winter, as the water, coming from under ground, was warm.

Wilkes Stuart: Draining is not a particularly expensive operation. I used to think it took a small fortune, but find it is not so. I do not like the glazed tile for field drainage.

Dr. Beal: I never heard of using glazed tile for ordinary drainage, except for connections.

Wilkes Stuart: I do not think the connections amount to anything, as they never come just where you want them.

Mr. Beam: Where small cobble stones encumber the surface they are often used as a cheap substitute for tile. Is that a good plan?

Dr. Beal: I have laid a good deal of such drain and there is not a rod of it that is worth a cent.

T. H. Stuart: I have had the same experience, even putting two feet deep of stone. It worked one season and was no good at all afterwards. I then took them out and put in poles from two to eight inches in diameter, and piled the stones in above. It worked one season and no more. I had the same experience with a cellar drain which I tried over and over again, and at last, six years ago, I bought tile at 3½ cents per foot and found it cheaper than hemlock lumber, and have had no trouble since. The same tile are now one cent a foot or $10 per thousand.

J. Macomber: I have tried a cobble stone drain and in the course of it passed through quicksand, where I used large stone and covered in with marsh hay. It has worked well so far—two years.

Mr. Wilsey: I have laid some board underdrains made of fencing that worked well till the boards rotted. Then I cut poles and slabs, cutting wedge shaped pieces from center to sap, and put the thin edge on the pole. The poles were tamarack, four to six inches in diameter. I was very careful in the bottom surface of my ditch. This drain has worked well for eight years. Another cat-hole I drained by setting two poles on the bottom and one on top, and covering with straw. As soon as the straw rotted my drain was spoiled, and I had to take it up. I re-laid without straw and have had no trouble since.

STOCK RAISING.

BY A. D. BANK OF DELTA.

[Read at the Charlotte Institute February 17, 1887.

The circumstances and surroundings of the pioneer were not such as to warrant the keeping of any but the most hardy animals. Stock now regarded as superior, in pioneer times did not find anything worth living for and usually died as the best way out.

Making farms of the wilderness required the application of muscle from beginning to end and muscle was in demand. It has not gone out of date yet, but there is nowhere such a premium on muscle as in new timbered countries. There everyone is rated on that scale. Even the schoolmaster and domestic animals are rated on the scale of toughness. This was all right and just as it should be for the times, but the mischief was in educating the rising generation. I can well remember seeing at the first fair held at Hastings, by the Barry county Agricultural Society, a Short Horn bull weighing 2,444 lbs. He was owned and exhibited by Judge Hannah, of Irving township, Barry county, who took great pride in exhibiting him.

The geeral verdict was, "The Durhams are a big breed, but they ain't tough; the judge paid a big price for his animal and fooled away his money." I went home from the fair with that impression, and I presume every other boy who attended that fair was taught the same lesson and the lesson was proven by demonstration. The Durhams could not live through the winter on straw and maple browse or marsh hay without shelter. It was a question of the "survival of the fittest" and the Durham did not prove fit to survive.

A short time after that fair a report was circulated that a man near Ionia had traded his ox team for a pair of Shanghai chickens. Perhaps some of you know of the circumstance. What an excitement that created! The biggest fool on earth had been identified.

In the spring of 1861 I bought a pair of six months' old Suffolk pigs, and when it was known that I had paid $15.00 I had plenty of callers to see them. The verdict was: "Too fine; not hair enough and too short nose; wouldn't shack well." I had paid five or six dollars more for the pigs than they were worth for pork, and there was another fool added to the list.

Things were different then from now. The farmer boy had an uneven hance all around. If a village clerk came to visit our school the girls were all after him, and that made us wish we were clerks instead of farmers, and our ambition to get an education was that we might become merchants or professional men. If a young man came home to the farm after having completed a college course, his name was added to the list of fools. He had thrown away his time and money in going to school. Any man that could read and write and figure interest had all the education a farmer needed.

What a change has come over us within a few years! Our farms are nearly all cleared now. The superstition in regard to improved breeds of stock is fast clearing away and better opinions relative to educational needs of the farmer are entertained.

One of our most intelligent citizens of Charlotte recently showed me a feather from a Brahma rooster that he went to Battle Creek to see. He told me the rooster was worth $100 and he was well paid for his trip over to see him. Another has a Short Horn bull for which he paid $700, and I have heard no one say he is not well worth the money.

I have a boy living with me who was born in the city of East Saginaw and lived there until he was over fifteen years old. He has been with me nearly two years, and says he is going to be a farmer. He is attending our district school, studies evenings, and believes a farmer should have a good education.

A few evenings ago I found in his book, not feathers from chickens, but a lock of hair. He told me whose head it was from. I asked him if the girls used that sort of a book mark. "Yes, Josie has a lock of George's hair and Jennie has some of Charlie's. Josie says her's represents blood that will tell, for George is going West to engage in stock raising. Jennie told her that was all right; it would be a good place for her and Charlie to go visiting. Charlie had just joined the Grange, and as soon as his education was good enough he was going to enter the Agricultural College, and when he graduated from that he was going to have his father's farm and, 'I think, Josie, sometime he will be governor of Michigan, and you will be pleased to have the governor and his wife visit you!'"

You see he is not pining to be a dry goods clerk.

POULTRY.

I know of nothing in farm life better adapted to open the business world to the little ones than raising poultry. Here they can get their first lessons in stock raising; and, as early impressions are most enduring, be careful how you teach. Let your poultry house and yard be comfortable and cleanly. Keep poultry that you will be proud to show to your neighbors, have a separate place where you can keep three or four of your choicest for breeding, for this is the only way in which you can excel in raising choice fowls. Pure breed does not imply perfection. Nature never repeats herself, and where there is a difference there is a choice. A friend once showed me a brood of pure brown Leghorn chicks. He pointed out two of the pullets which, he said, he would keep to breed from. I asked: What is the difference, being all of one brood and pure bred? He then placed side by side the two extremes in form. The difference was so great that my question seemed very foolish.

Help your children to keep a debit and credit account. Furnish them with old barrels in which to store the cleanings from coop and yard, and if they will deliver you the manure in barrels in payment for rent of ground and buildings you will have driven a sharp bargain; but if your poultry is allowed to roost in the barn on the farm implements, on the edge of the wheat bin, on the cutter dash in the summer and on the buggy dash in the winter, the gross credit side of the account would not pay the rent.

I will illustrate the value of poultry manure by relating a circumstance with which I am acquainted. A young man rented a field of eleven acres for a corn crop, paying cash rent. The land had been rented several years and was badly run. In the fall he told me he had raised a hundred bushels of ears of corn per acre, and that his neighbors told him when he planted it he could not raise thirty bushels per acre. Said he, when I rented the field I went to the swamp and got three big loads of muck and put it where it would dry. I mixed with it two loads of ashes and one load of poultry manure. As soon as I had planted the field I put nearly a half pint of this fertilizer on each hill. When the corn came up it looked as though it had something to feed on. That was the only fertilizer used and I am sure it made me more than 500 bushels of ears of corn.

HOGS.

In raising hogs there is better attention given to breeding than in poultry, but the same rules apply. Be sure to keep the best.

With nine farmers out of ten who keep hogs the profits of the corn crop lie behind the hog-pen. Valuable feed makes valuable manure, but that of the hog-pen, next in value to that of the poultry-yard, is wasted for want of absorbents and shelter. As a rule, the benefits to the farm derived from hog-raising can be put in a pig's eye, but it need not be so. Place your sty adjacent to your horse or cattle stable so that the manure from both can be put in one pile, and be sure to mix with plenty of absorbents. A farmer near Lansing is preparing to build a large hog-pen and store room for unthreshed peas combined. He harvests his peas with a horse-rake, without mowing, which leaves about ten per cent of the crop on the ground. After harvesting he first turns his market hogs on to the field and as soon as they begin to wander to find enough to eat he turns them off and turns on the pigs to clean the field. The harvested peas are for winter feeding to store hogs.

One advantage of the plan is that the straw furnishes plenty of bedding and absorbent.

CATTLE.

The tendency of the average farmer in raising cattle is to run them out. Most of us raise cattle for both beef and dairy products, and cattle meritorious as beef and dairy stock combined I believe to be most valuable for the farmers of Eaton county.

The cow that fattens fastest between the time she goes dry and the time she gives milk again is the best producer of rich milk. Such a cow was not a lean, raw-boned heifer, and none of her heifer calves should be slaughtered until they have been proven to be not valuable as milkers. Such a cow if allowed to go dry from two to three months will be quite likely to produce calves that will bring a good price for veal, and often they are sold for that purpose, while calves that do not take on fat readily and require feeding a week or two longer to fit them for market are kept to consume the products of the farm and make up the scalawag herd, which is never fit for market without a special effort.

When the butcher comes along and finds us with more cattle than we can winter our scalawag steers are not quite up to the standard. A little stall feeding is required to fit them for market. He will take the heifers and pay nearly the price of milch cows for them. They are the choicest of the herd, the only cattle in the herd that our sons take any pride in. Our boys do not like very well to milk, but the anticipation of having superior cows to milk had made them more contented. We have not shelter for the whole herd.

We need money to pay taxes and we finally let them go. We try to console the boys by telling them that the chances were they would not have been good milkers. "Mr. Jones's best looking cow, the one that is so fat all the time, is the poorest milker on his farm," etc., etc.

That way of cattle raising will never improve our herds nor make the boys contented. I presume not a farmer in this room who has farmed ten years but that keenly feels that he has wasted opportunities to improve his herd of cattle and lost money by that waste. Farmers are often compelled to make sacrifices in order to meet their obligations, but a sacrifice of the foundation of improvement of herd or flock is a sure road to bankruptcy.

Sell your poorest stock first every time. If an animal is running you in debt, the sooner you stop it the better. If your cows are natives or grades, cross with registered stock or market the calves before they are six months old, for they will have lost you money enough by that time. If you think the statement extravagant, please put six calves from native sire and six from registered sire in a field together, keep them equally well until a year old, then sell your shipper his choice of five and see if you get rid of a native. I have tried raising sires by crossing grade with registered, but the result has proven very unsatisfactory in every instance but one, and that one was not all I hoped for.

With the best of breeding you can not succeed in cattle raising without proper care. They consume the coarse products and require but little grain, but they want plenty to eat, plenty to drink and good shelter from storms. A great many farmers give their cattle the soft side of planks for a bed to lie on. I think it far better to cover the planks with clean, dry straw, and use plenty of straw to absorb liquid manure. The wheat straw from an acre of land can be used in bedding two cows in stanchions between October 1st and May 15th.

I remember a certain farm on which five hundred bushels of wheat were raised every year. No coarse grain, hay or straw was sold. The straw was nicely stacked just outside of the barn-yard, and the yard, which was small, was always covered with straw in winter, and looked inviting to lie down on. The cattle were stabled nights and always fit for market. By the 1st of May there was no straw stack on the farm. The farm was hilly and sandy, but the crops were always good and looked just as good on the hills as in the valleys. Before wheat sowing the last of the manure pile was on the field. The barn-yard was as clean as the door-yard. The products sold from that farm were butter, beef, pork and wheat, and as many tons of mill feed were bought as would be produced from the wheat sold, so that really only the flour was sold. That is the application of stock raising to farming that increases the productiveness of the farm and the wealth of the farmer. With a proper rotation of crops, sufficient first-class stock to convert into fertilizer all the vegetable products of the farm, and a wise use of the fertilizer, no farmer need go from home to get a remunerative price for his products, for they will be done up in neat choice packages ready for shipper or consumer.

HORSES.

Raise only the best standard stock of draft, farm, or all work horses. The demand in both country and city is confined principally to these classes. The railroads, the telegraph, and telephone are doing the messenger work, and fast trotting horses are not a necessity. I heard a good farmer remark the other day that Zack Chandler had done more for the farmer boys within a radius of fifteen miles of the Chandler farm than any other man in Michigan. Said I, "In what way?" "In turning their heads from the fast horse craze by introducing the Norman Percheron stock of horses." The boys think the Norman Percherons are all right, and so they are. They are noble looking horses, and answer every purpose of the farm.

The man who made this remark has brought up two sons, and brought them up well. They are graduates from our State Agricultural College. They are farmers and Grangers, and their father's remark is a pointer for us, not so much as to what breed or family of horses to raise, but how to make boys contented on the farm and grow to be good men and a power for good among men. And this should be our highest aim.

MEN AS DOMESTIC ANIMALS.

Webster's definition of stock is "domestic animals of the farm." Man is an animal. Domestic means belonging to a home, and that is where man belongs. I think every woman present will agree with me in this. If you do then man is a domestic animal.

The farm is the best place in the world to raise good men, and men should be raised on every farm. Until now I have left you to choose what kind of stock you shall raise, but I now say that it is the duty of every farmer to raise men. If God has not blessed you with your own offspring there are plenty of children without homes. You will find them at Coldwater, in the State School, and at Lansing, in the State Reform School for boys. Just as good boys there as you will find anywhere on your street; all they need is a home and to be taught how to be men, and it is our duty to give them a home and training. Take one of them to your home and let him know that it is his home by giving him a piece of your heart. Teach him how to till the farm, that it needs food to be productive, how to obtain food for the farm, and how to apply it. Teach him the difference between a scrub and a thoroughbred, that every man who is honest and true, whose aim in life is to better the condition of his fellow men, is a member of the royal family of men. Then, when your body shall have crumbled into dust, and your finger marks be erased from the land you have tilled, the impress you have made upon the immortal mind will still live, and will continue to live forever.

DISCUSSION OF THE PAPER

was opened by President F. N. Green: We have many animals on our farms that are "eating their heads off." There is no better county in the State than Eaton for meat production. England has become a great meat importing nation and offers an unfailing market. Meat butchered in Chicago can be and is sent fresh to the London market, and we can compete successfully with any other source of supply. The following extracts from articles in the Breeders' Gazette of February 3, 1887, give an idea of

THE STOCK-CARRYING CAPACITY OF AN ENGLISH FARM.

One of our English exchanges, in connection with a notice of the fine Short Horn herd of Mr. William Handley at Greenhead, gives some facts about the number of animals maintained upon the farm which may be instructive to American farmers. The farm at Greenhead contains 201 acres. The live stock consists of about one hundred head of cattle—thirteen bulls and bull calves, thirty breeding cows, and the remainder heifer and heifer calves of various ages. From 200 to 300 sheep are kept and four work horses, besides pigs, poultry, etc. The crops of the farm this year consisted of seventeen acres of roots, yielding thirty tons per acre, about half an acre in potatoes, thirty-two acres in oats and the remainder in grass. It is stated that all the food required for this stock is grown upon the farm with the exception of a little cake daily, and it is the opinion of English farmers that they can always offord to use cake if they have suitable foods to feed with it.

Another English exchange, the Agricultural Gazette, gives an interesting account, written by himself, of the farm and operations of Mr. Edwin Ellis, of Guilford, many of the details of which will be of value on this side the water, notwithstanding our different methods of agriculture. Mr. Ellis' farm embraces some 350 acres, of which sixty are meadow and the remainder arable. The area in pasture is not stated, but it is evidently included in the arable lands and forms part of the regular rotation. The soil is light and the farm would not be called rich. Upon it, however, he carries an enormous quantity of live stock, consisting of twenty-five Bates Short Horn cows and thirty of their progeny, a flock of four hundred Southdown ewes and two hundred "tegs," as sheep within a year old are called, and, besides, an average of seventy other cattle purchased outside and undergoing the fattening process. With such an amount of live stock he is able to maintain the farm in the high state of fertility necessary in that country without resorting to the use of commercial fertilizers, the purchase of which is so serious a charge upon most farms, and to conduct a prosperous and profitable business upon a farm which with ordinary methods would involve him in present or prospective bankruptcy.

Mr. Ellis' feeding operations are mainly in the direction of buying calves or very young stock and forcing them for "baby beef," which is sold, as the market seems to best favor, at anywhere from twelve to sixteen months, but occasionally, if prices are not to his liking, they are held longer, the advantage being that having his animals ready for beef at one year old they can be sold at any time after that when the market is most favorable ; or, being in the full vigor of early growth, they can be kept another whole year, if necessary, and make profitable gain all the time. The weights, as the stock is usually sold, range from a little over nine hundred to about thirteen hundred pounds, depending upon age, and where held longer mention is made of steers of about seventeen hundred pounds at less than two years old.

Mr. Ellis says: "I buy the best Shorthorn calves I can get. The dealers in this neighborhood who gather calves from the West of England know when they have got a 'clipper' where to take it, and they naturally require a high price for such. But he must be a good one." It appears that he has had occasion at times to feed three-year-old Irish steers, which would likely compare favorably with those upon which the majority of American farmers are wasting their feed and opportunities, and he declares that "ten bullocks of this latter character consume more food than twenty young steers in good condition at sixteen months old." There is something significant in the fact that wherever there is found a man who has achieved anything in the way of exceptional success in the handling of live stock it always turns out that he has done it with the best kind of stock he could get ; that where anyone is disposed to brag of what he has made with live stock he has invariably made it with good stock; that when a high price is paid in the market it is invariably paid to a man who has good stock.

No one ever hears of this sort of testimony being offered in favor of the scrubs.

Mr. Claflin: I want to know what is the most profitable stock to raise.

Mr. Green: A year ago August I sold three steers weighing 1,120, 1,250 and 1,280 pounds, two were half breed and one a high grade. A neighbor had eighteen scrubs, and the man who bought mine would only take seven out of the eighteen, and those seven averaged 1,050 pounds, and were two and three years old. I have a pure steer that weighed 892 pounds at one year, and gained one hundred and eleven pounds in thirty days. I feed all they want of corn and oats ground half and half and an equal bulk of bran. I give all the grain they will take. I never kept record of cost from birth on. I would keep animals in condition to sell at any time, so as to take advantage of markets, and then sell at earliest favorable opportunity. I never fed corn and cobs ground together.

Mr. Claflin: How much more does it cost to raise a three-year-old colt than a three-year-old steer?

Mr. Pray: I never plan to feed over two and a half years, and I average $50 per head. I sold a three-year-old Short Horn heifer for beef for $100.

Mr. Green: The risk is much less in raising cattle than in raising horses.

Mr. Otto: My horses are grade Percheron. I give the first year, to colts, exercise and plenty of hay, ground feed, shelter and bedding, and after the first year no grain, but plenty of good hay and bedding and a roomy place for exercise. I winter twenty-five to forty head. I have kept cattle, and think the cost of keeping no greater to raise a three-year-old colt than a three-year-old steer; the former sells for $30 to $50 and the latter for $150 to $200.

Mr. Green: Mr. Otto, in counting the cost of a steer, should estimate the value of a grade steer higher. Is it better to let a colt rough it after the first year or to force it till three years old?

Mr. Otto: I do not believe in forcing, or grain or grooming. Colts are better raised on hay after the first year. Crowding colts spoils them, makes them so frisky that there is more danger from kicking, slipping, etc. Horses average two tons of hay apiece for a winter (my breed).

Mr. Scott: Is there not less danger of overfeeding the lighter breeds of horses?

Mr. Otto: I doubt it.

Mr. Sherman: Is it not dangerous to crowd any animal?

Mr. Otto: I think so.

Mr. Green: More animals are starved than there are that get enough. The only harm in crowding is where there is no exercise, e. g., in stall feeding.

Mr. Otto: As to profits of colt raising. Last year I found a large demand for horses and sold in February a three-year-old span not halter-broken, three horses coming four years old, and a pair of five-year-old mares with no fitting, and the seven head brought $1,350. I can't fix the cost of raising. The mares had each raised a colt, and they were grade Percherons and their dams were natives. My first start was with grade mares and horses.

Mr. Claflin: Were not those seven horses better than the average of your stock?

Mr. Otto: No, they were not near up to the average of my present stock.

Mr. Sherman: What does it cost to raise a three-year-old colt?

Mr. Otto: The first year I feed one quart of fine middlings mixed with cut hay night and morning during the winter. I cut the hay into a box, wet it down, pour on the fine middlings, stir and carry in baskets to the trough from which the colts eat. I never steam food. I only feed grain four or five months in the first winter. I keep a large growth of June grass pasture and keep them on that during severe weather till Christmas, taking them in on stormy nights. At four months old they will sell for the price of a three-year-old steer.

Mr. Banks: At Mr. Otto's figures a three-year-old colt would cost as follows:—

First cost of colt to buy for raising	$60.00
150 days' grain, one quart night and morning	4.50
6 tons of hay at $10.00	60.00
Pasture at 25 cents per week	22.00
Cost at three years old, not counting care	$146.50

Mr. Green: Another consideration in comparing cost of raising cattle or horses is the difference in the insurance of the animals. A good Short Horn sire can be got for $150, while a good Percheron sire will cost $1,000. (Mr. Otto: I paid $1,900 for mine.) The matter of capital involved counts for a good deal in favor of cattle raising.

LIVE STOCK.

BY M. W. SCOTT.

[Read at Fremont Institute, February 4th, '87.]

The most reliable historical authority says that during the first half of the last century beef cattle did not arrive at maturity until the age of six or seven years, and the average dressed weight did not exceed 370 pounds; and that the average dressed weight of sheep was not above twenty-eight pounds. Recent reports and statistics in the Department of Agriculture place the average time at which beeves are now killed at three years and the average dressed weight at upwards of 800 pounds, a saving of one hundred per cent in time and upwards of one hundred per cent in weight; and the average dressed weight of sheep upwards of eighty pounds, almost treble the weight in the last century. The censuses of 1850 and 1880 show the average wool-clip per head has nearly doubled in thirty years.

Now, by making a comparison between the unimproved "Long Horned" cattle of the Southern States and the modern, improved "Short Horns" of the North, we can again see something of the results of improvement. In 1882 there were shipped from Key West, in Florida, 27,271 cattle valued at $410,758, and from New York there were exported 33,412 head, worth $3,332,004, the native, unimproved cattle averaging $15.05, the others nearly seven times as much, or $99.72 per head. This means *practical utility—dollars and cents.*

GRASS CULTURE—STARVING CATTLE.

But now let us find if we can how this transformation has been brought about. From the time of the first settlement of the colonies up to the middle of the last century, the practice of sowing grass seed. cultivation of the grasses, making and saving hay was wholly unknown. The cattle of those days were allowed, or obliged, to shift for themselves, summer and winter, except in some cases where they had a little straw, with rough fodder, and what swale or marsh hay could be found.

One colonial historian says the "cattle were so utterly neglected that it was quite common for the multitudes that starved to death every winter to supply hides enough for shoeing the negroes on every farm." This was a matter so generally and constantly anticipated that my own grandfather, I have heard, was once very near turning off a good overseer because cattle enough had not died on the farm of which he had the supervision to furnish leather for the negroes' shoes. Another writer says, "They neither housed nor milked their cows in winter, having a notion that it would kill them."

OLD FOGYISM.

Similar conditions, it seems, prevailed in Europe as well as in this country. Agriculture as a science was beyond the comprehension of the age. Crude ideas, prejudices, and superstitions—that it seems difficult for the people of the present age to comprehend—prevailed everywhere. And everywhere almost impregnable barriers to progress seem to have been built up by the farmers themselves. Everything that breathed of books, learning, or improvement was an innovation that their ideas of propriety could never sanction. One historian says: "The farmer who ventured to make experiments, to strike out new paths of practice, or to adopt new modes of culture subjected himself to the ridicule of a whole neighborhood," and that "we, at this distance of time, can with difficulty realize the extent of the prejudices which blinded the eyes of the people of those days."

A later writer says: "Custom had marked out a road for them, and it was smooth and easy to travel, and, though it might be a circle that brought up just where it started, it had the advantage in the old farmer's mind that in it he never lost his way. It didn't require any exertion of mind. His comfort as well as his happiness was based on a feeling of filial obedience to old usage that was hereditary in his being. It was born in the blood and ruled him with an irresistible power. The old common law, based on precedent, custom, practice, was his guide and rule. He would be governed by custom, not by reason. If ancient custom was known, that was good enough for him. It wasn't for him to doubt. To investigate would imply doubt. To investigate was to theorize. Theory is at the bottom of all investigation, and theory was a bugbear in his mind. The logical result—that no improvement could be reached without investigation—had no terror for him. He seldom read. The written word he received with distrust. It might contain principle, and it wasn't principles that he cared anything about, but practice. No matter whether founded on wisdom and experience or not, practice was the thing."

CRANKS.

But a change has come, superstitions have been uprooted, prejudices have been broken down, and men have dared to investigate—dared to theorize, even in the face of ridicule and derision. Agricultural and industrial schools have been built up. Agricultural societies have been organized—all educational in their tendency and purpose. Books and papers in the interest of farming have been scattered broadcast over the land. Law in a thousand ways encourages improvements in the methods of tilling the soil, science now begins to illuminate the way, and lends its best appliances, its best brains, in the study of the principles which underlie a progressive and successful agriculture.

The work was slow at first. Here and there some crank of a farmer began the study of the chemical properties of the soil he tilled—its wants and how he could supply them. Another, more crazy still, commenced the study of the laws of "plant life," their wants, and how they could be supplied. And others still the laws of "animal life" and development, selection, feeding and breeding—all of them parts of the same great work; a study of "Nature's laws" in the interest of a better and a higher civilization.

One of the first and most significant of all the innovations that have taken place in the chain of agricultural improvements was the practice of sowing grass seed, which, strange as it may seem to some of us, is but little more than a hundred years old. To-day the direct products of grass and hay outrank in value any other products of the soil by many millions.

BAKEWELL.

The way had now been prepared for raising, feeding and keeping the domestic animals in quantities sufficient for all the uses of man, without danger of losses from starvation in winter, and Bakewell and a few others began their work of investigation and improvement. And unlike many others whose inventions have added largely to the prosperity and happiness of mankind, they lived to reap some of the fruits of their labor. Bakewell sold single animals for twelve hundred pounds sterling ($5,800). Farmers began to open their eyes, there was money in it as well as science. The change was far more rapid than anyone could have reasonably anticipated. And within the last half century the results of their study and experiments have been scattered far and near—to almost every people and every land where modern light has been allowed to penetrate.

This brief reference to historical facts and figures points out the susceptibility of our domestic animals to improvement, teaching a lesson that farmers should not be slow to heed. With us the time has now come when the crude methods of farming, unavoidable while clearing the forest and building the farm, must of necessity give way to more thorough systems of farm management. While the lumber interests and markets have practically disappeared and the home markets are relatively decreasing, the surplus production that must necessarily find some outside market, has been rapidly increasing. And while railroad freights and transportation must necessarily come out of the price of our products, more beef, more pork, more mutton and wool means less freights. It means also increased fertility of the farm. The force of the old maxim, "No cattle, no manure; no manure, no corn; no corn, no cattle," can never wear out with onr system of farming. Stock, with mixed husbandry, are indispensable. They must be raised in large and increasing quantities.

And every farmer should study, as best he may, from his own standpoint, to build up stock distinctively his own A stock that he may be able to recognize wherever he sees them. This has already been done, to some extent, in our county. They may not be thoroughbred, but they may be a family of grades so near it that, for all practical purposes, so far as dollars and cents are concerned, the average farmer need know no practical difference. Good, well developed, well fed, grade beeves bring just as much in the market as thoroughbreds.

But a neighbor of mine says he knows a man who raised scrubs, and he got rich. Well, I know a man who can neither read nor write, and he got rich too. But I don't apprehend that the fact that he could neither read nor write added very materially to his wealth. Money in scrub live stock is a thing of the past.

BREEDS OF CATTLE.

But says my neighbor, there are so many different breeds, with their advocates all crying "the best," that one cannot well determine what type or family to select. It is the market, the situation, the surroundings that must determine this question in every case. If it is the dairy business, then the delicate little fawn-colored Jersey, with her rolls of golden butter that count you out a dollar a pound (if you have that kind of a market) that is distinctively the dairy breed. Perhaps scarcely more so than the larger Ayrshire, both noted everywhere for the quality of their milk. But if you are situated where the market pays better for milk than for butter, and quantity instead of quality is desirable, then the larger and coarser Holsteins stand at the head of the list—the best milkers. But if we are to choose for general farm purposes, for dairy, beef, and work cattle, then Short Horns and Herefords head the list everywhere.

The Durhams and Herefords make fair milkers, excellent work cattle, and when you are done with them for other purposes they are worth all they cost for beef; and beef is the watchword so far as stock is concerned, with all farmers engaged in a diversified husbandry. Repeated experiments have demonstrated that it costs fifty per cent more to make a hundred pounds of beef on a three-year old than it does on a yearling; that after eighteen months of age the profit of feeding steadily declines with the increasing age of the animal; and that there is an actual loss in feeding cattle over three years old for beef. Boards of Agriculture in some of the States are now refusing premiums for beeves over three years old, on the ground that they have no right to encourage what they know to be unprofitable methods of farming. And another fact we should never lose sight of—grade animals produce a larger percentage of dressed beef, as compared with gross weight, than natives, and of a better quality; hence larger profits and more ready sales.

SHEEP, HISTORY OF MERINOS.

What was formerly known as the "native sheep" have been described by one who knew them as a "coarse, long legged, light bodied and unprofitable animal," and the change has been made principally through the importation of the Spanish Merinos, which, though themselves an inferior breed, through judicious selection, feeding and breeding, have developed, in less than half a century, the most valuable breed of sheep known in the world—the American Merinos.

The first recorded importation that we find of the Spanish Merinos was made in 1793 by William Foster, of Boston, but they were not appreciated and were given to a gentleman near there to keep. Seeing no practical value in them, the record says, "he simply ate them." But in 1810, Elkanna Watson exhibited three Merino sheep in Pittsfield, Massachusetts. It was an innovation upon old customs, and became, at first, the subject of much ridicule and contempt among the farmers. But fabrics made from these fine wools established their value and created a demand, laying the basis for the rapid increase and development of the Merino sheep; and the gentleman who "simply ate" the Merinos in 1793 afterwards paid a thousand dollars for the same class of sheep.

They now form the basis of nine-tenths of all the sheep of this country, and have largely increased the weight of carcass and increased the fineness of the staple from 750 fibres to the inch—at the time of their first importation—to 1,443 at the present time. They have repeatedly demonstrated the fact that when bred for that purpose they can gradually be changed to a first class mutton sheep, and a judicious cross with the larger Cotswold and Leicesters gives a "medium" staple of wool that commands at the present time the highest price in the market.

CONCLUSION.

The best stock, the best products of the soil, the best education and the best brains will always command the highest price in the market. To comprehend this rule fully, it occasionally becomes necessary for us to give ourselves a vigorous shake, and get out of the ruts, with our stock, our farms and ourselves.

Some one has said, that "everything that brings the farmer to the surface results in good, but every thing that brings him to the top is better still." God and nature made the occupation noble; and who shall say that the skilled toil and industry of the farmer that brings in glorious abundance from the brown soil, the food and the fabrics that feed and clothe earth's millions, is not justly entitled to the best that earth, art and science can produce?

IMPROVED LIVE STOCK FOR THE GENERAL FARMER.

BY J. W. HIBBARD.

[Read at the Farmers' Institute at Bancroft, February 15, 1887.]

I do not wish to be understood that the general farmer must be a breeder of thoroughbred stock, but in my opinion he must improve the stock he already has, for it is an undisputed fact that the scrub will always bring its breeder and feeder out in debt.

With our high priced land and low prices of produce, we must make the land produce all that is possible, and so dispose of the produce that it will bring the most money, and I know of no better way to accomplish this than to combine the raising of improved stock with our farming. As proof of this, let us look back to our mother country, old England, with her high rents and taxes, and we find that they were obliged to improve their stock, and with this they have brought their soil up to the highest state of cultivation. In Holland, too, we find them improving their stock in certain lines for untold years. We are told that the people of Holland are slow to adopt new mothods, but yet we find them with improved stock as a necessity to profitable agriculture.

On the little island of Jersey with her immense population and small area of land from whence to draw her support, they were obliged to improve their stock so that it should subsist on the least possible food and yet produce a large amount of butter, hence we have the little Jersey, an animal of very small stature, but yet the greatest of butter producers. Why is it that with all the opportunities possible we are behind other countries? Our best farmers find it profitable to procure a full complement of the latest improved implements and to invest in suitable buildings to shelter them when not in use, and why will it not pay to apply the same rule to our stock. But it will not do to say that the Americans have never done anything toward the improvement of their stock, for some of our more far-sighted forefathers saw the value of improvement in the stock of the country and have produced a few breeds of purely American type and origin. The American Merino sheep is so improved on the old Spanish sheep of 1812 as to be fairly called an American sheep, the greatest producer of fine wool of any sheep on the globe, and, in fact, becoming known as such to the other wool producing countries and being imported there with the very best results. The cross of the American Merino upon the Australian sheep beat anything they had there, and yet they had thought that they had the model wool producing sheep before that. America has also made the now standard trotters, the most speedy and enduring of his kind, and in some classes of swine and fowls we have almost or quite established a perfect and permanent standard.

SCRUB VS. IMPROVED DAIRY COWS.

If a scrub cow that will make six pounds of butter per week pays for her keep, and, by the use of a thoroughbred sire from some of the dairy breeds, her offspring can be made to produce eight or ten pounds of butter per week, the cross has given us a large margin of profit where before we had no profit. The keeper of a dairy herd should thoroughly test his cows and know whether they are paying him or not, and immediately beef the unprofitable ones.

January 31 good mixed butchers' stock, fat cows, heifers and light steers were quoted at $3.40 to $3.75 per cwt., that being the best class that is marketed from the common stock of our country, and on the same day we find extra grade steers, weighing 1,300 to 1,450 pounds, quoted at $4.50 to $5 per cwt. Here we have a difference of about $1 per hundred in favor of the improved stock, and this is not half the story, for the general average weight of the first class is only eight or nine hundred pounds. At the heaviest weight and the best prices they would bring $33.75 apiece, while the grade, at 1,300 pounds and $5.00 per hundred, would bring $65.00 or almost double the price of the scrub—a good return for the use of a thoroughbred sire. Doubtless, too, the better animals were better fed, but the better feeding counts for more with the better breeding.

SCRUB AND GRADE SHEEP.

The common sheep of our country will shear four or five pounds per head of a poor quality of wool, which at thirty cents per pound gives $1.50 per head. The improved American Merino or their grades shear as high as ten or twelve pounds of good market wool per head that is of a much better quality than the former; this at the same price per pound gives us double the amount obtained from the common sheep.

COST.

But some say, as they said of improved implements, that the implement costs too much and that it takes too much labor to take care of good stock. To such I would say that all we get from our farms is the pay for our labor, and for me to labor without pay is poor fun, hence I shall choose to labor with good stock that do pay a profit rather than with scrubs and get nothing but my labor for my pains.

Mr. E. A. Burnett: We hear even breeders of improved animals say that the feed makes the animal. Now can you make an improved animal from a scrub by good feed, or can an improved animal be profitably kept by common feeding?

Mr. Hibbard: Improved stock and improved feed should go together.

Mr. Burnett: Does it take more feed to produce a pound of meat on common stock than on improved stock?

Mr. Hibbard: Yes, it costs one or two cents per pound more on common stock.

Dr. Miles: It is a popular idea that when one gets a pure-bred animal he gets something that will continue constant, and this is a mistake. The animals on your farms are continually changing. One who buys blooded animals, forgetting that they are the product of special influences, and subjects them to the ordinary surrounding influences which have produced the scrub, will but meet with disappointment.

SHORT HORN CATTLE.

BY J. S. FLINT OF SOMERSET.

[Read at the Hanover Institute, Feb. 8, 1887.]

Mr. Chairman, Ladies and Gentlemen:—It is recorded in history that the earliest improvement of the Short Horns began in the counties of York and Durham, England, sometime early in the 17th century; yet it is believed that they were an established breed, and as compared with other breeds of cattle of that day, a decidedly meritorious breed for many years anterior to that time. All early accounts of the Short Horn seem to concur that they were from the first remarkably well adapted to feeding purposes, possessing the ability to lay on their flesh evenly and rapidly, ripening at an early age, and attaining great weights.

The cows have always been remarkable as dairy animals, yielding large quantities of milk of excellent quality, whenever any attention has been paid to this particular branch of their usefulness.

The question is often asked, what is the true and best color of the Short Horns? From the first the white, cherry red or any admixture or combination of the two have been recognized as characteristic colors. As to the best, color cannot be eaten, hence one is as good as another, provided no shade of black appears, as that is a sure sign of defective pedigree.

The first Short Horns found their way to America through the enterprise of a Mr. Heaton, who emigrated from England to New York about the year 1775, and followed for some years the occupation of a butcher. His calling afforded him the means of knowing the deficiencies of the common cattle then bred in the vicinity. His first importations were made in the year 1791. The results were so satisfactory that he returned to England again in 1796, this time selecting stock from the herds of Robert and Charles Colling. The descendants of these cattle were a very valuable stock, the impression of which could be traced for many years, until at last through the non-appreciation of other people of that vicinity, they "ran out," or in other words, were lost in the common herds of the country. Other enterprising gentlemen of Kentucky, Ohio and New York were not long in deciding to follow Mr. Heaton's example, until now every State and territory is in possession of their blood; everywhere they meet with appreciation, and everywhere demonstrate their value. Once tried they are never discarded. The great demand for them has always rendered their breeding remunerative, and at times they have reached very high figures. At the New York Mills sale, September 10, '73, which was the greatest cattle sale so far known, one hundred and eight animals averaged three thousand five hundred and twenty-three dollars, and one animal brought the astonishing price of forty thousand six hundred dollars.

For the great majority of farmers the all-work horse is the best, and for the same class the general purpose breed of cattle is the one wanted, and this we emphatically assert is the Short Horn. We hear and read a good deal about the various breeds, "the cow of the future," "the coming breed," etc., all tending to foster expectation of a great revolution in cattle matters, but we predict that the Short Horn will emerge from the midst of all these controversies with fresh honor, equaling the best averages of all rival breeds.

The demand for improved cattle of some kind or breed will certainly extend. Our agricultural circumstances greatly favor its extension. Within the next decade greater strides will be made in the improvement and extension of live stock than ever before. Improvement is made, has been made, will be and can only be made by comparison. Hence arises the great good of all well conducted fairs and stock shows; they cannot be too well supported. In no other way can so large a number of breeders, farmers and good judges be brought together to compare ideas, results, and fine specimens.

Many are slow to realize how much they could profit from a study of the experiences of others found in the best agricultural papers. In this experience we mingle with the more cultivated classes of cattle breeders, observe the drift of discussions and profit thereby.

Many are also slow to profit from the lesson worked out time and again for the public good at the Fat Stock Shows, Agricultural Colleges and from the experiments made by individuals. I was advised that I could never understand pedigrees and breeding well enough to protect myself against the shrewd competition existing among breeders; that I could not sell my surplus stock after I had bred it; that those so much better to do financially than myself would do the selling and I would be obliged to occupy the rear ranks, overstocked. I have had the pleasure of criticising their judgment, as I have never been overstocked and sincerely believe in the maxim "What man hath devised man can comprehend." Men in search of good cattle will buy them wherever they find them, whether it is in some lane, of a day laboring man or from some millionaire or cattle king.

BREEDING DAIRY COWS.

A PAPER BY MR. E. A. POWELL, OF SYRACUSE, READ AT THE FARMERS' INSTITUTE, IN ITHACA, N. Y., FEBRUARY 18, 1887.

[The following valuable article I have been requested to insert as of especial interest to Michigan Farmers.—H. G. R.]

No important national agricultural industry is more susceptible to the influence of judicious management and intelligent enterprise than the production of milk, and yet no other industry of equal importance to our whole country has received so little scientific, intelligent study from those who depend upon it for a subsistence or follow it for a profession, or so little encouragement from the State or nation.

The cow is the most sensitive, complex and intricate piece of machinery in use in any branch of agricultural industry, sensitive to every change, every touch, ruined by neglect, improved by care, easily doubled in capacity by judicious management and enterprise on the part of the owner, and yet how few make any attempt at improvement, fully four-fifths of the dairymen of the country still using the old machine, which only produces 3,000 to 4,000 pounds of milk per year, while the best, from the same raw material, will produce fully double that amount. With intelligence in breeding, good care and good judgment in feeding on the part of all concerned, the yearly product of the dairy cows of the United States could be doubled in one decade.

There are four methods by which this important machine can be improved, viz: By increasing the feed, by better care, by selection, and, above all, by breeding. All these methods are essential—all should be applied—but the last is indispensable in attaining the best results.

By higher feeding you merely increase the power that is applied to the same old structure, by special care you put it in working condition, but remove none of its natural defects; by care in selecting you secure the best of its kind, but by judicious breeding you can add all the improvements, all the new methods, can make the best combinations, and by this last method only can you attain the highest degree of perfection.

You have in one family the machine which will make the largest amount of milk, in another that which will produce the most butter, and by combining the two you have in the union that which will give the largest return of both milk and butter. To this you can add all necessary attachments, can embellish and beautify the structure as taste and judgment dictate, adding beauty to utility, and thus, by the practical use of science, good judgment and common sense, build up the most profitable, useful and beautiful machine on the farm—the ideal dairy cow.

GOOD FEEDING ALONE INSUFFICIENT.

As an evidence of the uncertainty of depending upon high feeding for a large production, I will compare two cows in the Lakeside herd, of the same age, of about equal size, and each of which had been the winner of high honors, awarded by competent judges at some of the largest exhibitions in this country. These cows commenced their records at about the same season of the year, were kept in the same stable, fed alike, were milked and cared for by the same men, and one gave for the year over 12,000 pounds of milk, showing that she was very superior, but the other gave over 20,000 pounds, a difference of 8,000 pounds in one year. One machine, manufactured from the same material, at the same cost, 8,000 pounds more milk than the other. The quality of the milk of the two was proven by tests to be about equal. These were careful and accurate tests. I could mention a score of similar comparisons, showing equally astonishing results. You will thus see that you must have something more than feed and care to obtain the largest product.

APPEARANCES UNCERTAIN.

Selections made from outward appearance are equally uncertain. At one of the leading fairs of our State two heifers were entered for the same prize; breeding was ignored and two expert judges were chosen to decide upon the merits of these two beautiful animals, with others. Both were fine, and so similar in appearance that the casual observer would hardly distinguish one from the other. They were subjected to all the scrutiny which usually characterizes such inspections, the softness of coat, mellowness and color of skin, development of udder, size, length, direction and branches of mammary veins, the size and number of orifices at termination of veins, the construction of the vertebra, length of tail, the class and order of escutcheon, the head, neck, horns, eyes, limbs, etc., etc., all received due and careful consideration—and what was the result? The one which her owner knew to be the poorest in breeding, and which they valued far below her mate, was pronounced MORE MILKY and she left the ring clothed with honor. The other quietly joined the large circle of the vanquished. The following season both heifers were put to the only true test, that of actual performance, and the discarded heifer produced about double the amount of both milk and butter. A few years since one of the most noted expert judges of Holstein-Friesian cattle in America visited the stables at Lakeside, and was asked to select the best butter cows. After a careful inspection he selected several which he pronounced the best. Accurate tests have proven that he did not select any one of a dozen of the best butter cows in the herd, nor did he choose one out of the family that has excelled all others in the herd. I could mention any number of tests by experts which show similar results. Do not understand me to pronounce these judges incompetent. Not so. They were all honorable, experienced, competent, well-informed gentlemen, and did as well as any parties could do by the same method. I merely mention these facts to illustrate the uncertainty of any judge who does not depend upon the breeding or performance of the individual or her ancestors.

PEDIGREE THE SUREST TEST.

We will mention a few records which show the results of breeding, as proven by actual tests.

Two cows of the same breeding, quality and production on the side of the dam, but by different sires, one being used on account of his superior appearance, the other for his breeding, and, under like conditions, one cow gave about 10,500 pounds of milk in a year, while the other gave nearly 18,000 pounds. The former made about 11 pounds of butter in a week and the latter over 22 pounds. Two heifers, from the same dam but by different sires, one of which was especially noted for the butter qualities of his get, and his ancestors, were tested at about the same age, at the same season of the year, on a similar quality and amount of feed, when giving about the same amount of milk, and one actually made over 110 per cent more butter than the other.

The only Holstein-Friesian cow, in fact, I believe, the only cow of any breed that has made 304 pounds 5½ ounces of unsalted, well-worked, butter in 90 days, was selected when an inferior looking calf, in bad condition, entirely on her breeding and the reputation, qualities and superior production of her ancestors.

The only heifer, I believe, on record which has ever made at 28 months of age 21 pounds 10¾ ounces of unsalted butter in a week, was bred with the expectation of producing some such result. She was the produce of one of the best butter cows, from one of the most noted butter families of the breed, bred to her full-brother. By this close breeding the strong butter qualities of the family were intensified, and this phenomenal heifer was the result.

The 3-year-old Holstein-Friesian heifer Albino 2d, which made last week 25 pounds 5½ ounces of butter and gave last year as a 2-year-old 18,484 pounds 13 ounces of milk in a year, sprang from a remarkable butter and milk family. Her dam made 17 pounds 13 ounces of butter in a week, in the hot and unfavorable weather of August, on grass, without grain of any kind, and had had none for several months. Her grand-dam made 97 pounds 5 ounces of butter in 30 days and gave 956½ pounds of milk in 10 days. Albino, the dam of this, the most remarkable heifer the world has yet produced, was bought at a very high figure as a yearling, on her breeding.

Whole families show in an equally marked degree the effect of judicious breeding. You are all familiar with the remarkable butter records made by whole families of Jerseys which have long been bred expressly for that purpose. Whole families of Holstein-Friesians are proving equally remarkable in this respect. An entire family of twenty cows of this breed shows an average of 18 pounds and 1 ounce of butter per week, eight of them being heifers from two to four years old. Thirteen of these, including all the mature cows, averaged over twenty pounds. Thirteen of these cows were tested by carefully keeping the weights of milk at the time, and it was found that the average for the whole was a pound of butter from 18.82 pounds of milk. Some of them made a pound of butter from thirteen and fourteen pounds of milk. The value of these tests will be more fully appreciated when it is known that this whole family of mature cows which were tested for the year averaged 16,006 pounds of milk for the entire number. Thirteen cows in one herd average over twenty-three pounds of butter per week; forty cows in the same herd have made butter records which average over twenty pounds per week, and thirty (two-years old) average over twelve pounds in a week. In another herd, five cows average over twenty-three pounds; twelve cows average over twenty-one pounds, and twenty-nine (nine two-years old) average seventeen pounds. Had I the data at hand I could give similar records from other herds.

In the advanced Registry for this breed, 349 cows are recorded, and about half of them go in on butter test, the rule requiring fifteen pounds per week for cows, thirteen pounds for four-years, eleven pounds for three-years and nine pounds for two-years old.

My purpose is not to recommend to you any particular breed. This important subject you must decide for yourselves, but, having decided, start with the best of its kind, or, having started, go up higher. The summit is still an unoccupied field.

In selecting stock which has not been proven by actual tests, be not deceived by a pedigree which is only a collection of unknown names, for pedigree without performance is valueless. A reliable perfect pedigree should be a continuous history of great performances by an unbroken line of illustrious ancestors.

Performance without pedigree is also of little value, as it furnishes no evidence of prepotency.

"The merits of a family should not be measured by the records of a single individual, but by the combined or average product of a majority or the whole."

SHORT TESTS MISLEADING.

Do not estimate the value of your cows by the result of a day, or a few days' trial; such tests convey a very inaccurate idea of actual worth.

At Lakeside two cows commenced their year's records at about the same time, were fed the same, milked and cared for by the same men; one gave a few pounds more for a single day—about the same for a month—nearly as much for six months, and yet at the close of the year the record of the cow which gave the least for a day exceeded the other by over 9,000 pounds, an amount which is equal to the yearly product of two of the average cows of our State; yet had these cows been judged by a short trial the poorer would have been declared the better. The actual value of a cow can only be known by a year's trial.

You will observe, gentlemen, that I have not made extreme comparisons, have not pitted the inferior or common cow against the best. Had I chosen extremes, I would have shown you that while many ordinary cows do not average 3,000 pounds of milk in a year, a phenomenal one has given over 26,000 pounds in the same time, thus requiring over eight to equal one. While the average of the cows of the great Empire State, if my memory is correct, is only about 4,000 pounds per year, large herds, counting all the mature cows, have averaged over four times that amount.

I have confined my comparisons to No. 1 animals of the same breed and in the same herd in order that all the conditions might be equal.

By continuing our investigations into other fields we would find that the influences of breeding are equally, or even more marked in other domestic animals.

You would find that a large share of the great trotting horses of America have descended from one great fountain-head. You would find that the successful breeders of horses estimate the value of their stock almost entirely by their pedigrees. You would find that by breeding for a specific purpose the dwarfed, diminutive Shetland pony can be transformed and built up into the mammoth and powerful Clydesdale.

So accurately can the thoroughbred horse be judged by his breeding that the most noted and skillful turfman in America, in his counting-room in New York, will pay his thousands for the undeveloped colt in Kentucky, with which to win the Derby. American dairymen and breeders of dairy stock underestimate the value of this important factor in developing and building up the great industry which they represent. In this respect we are far behind the breeders of many other domestic animals.

The domestic animal in the hands of the intelligent breeder is like the potter's clay in the hands of the skilled artist. It can be moulded, shaped, changed and finished according to the will and skill of the artisan.

So marked are the influences of intelligent breeding that the will and wish of the understanding breeder of to-day will be stamped in legible characters upon the flocks and herds which will graze on the fields ten years hence.

WHAT AND HOW TO FEED FOR GOOD QUALITY AND LARGE QUANTITY OF MILK.

BY PROF. SAMUEL JOHNSON.

[Read before the Dairymen's Convention at Flint, February, 1887.]

In a recent work on "The Landed Interest," by Sir James Caird, author of "English Agriculture," in discussing the causes that have contributed to the development of English agriculture, he refers to the fact that "in the last thirty years the change has not been in any considerable progress beyond what was then the best; but in a general upheaval of the poorer and the worst farmers toward the higher platform then occupied by the few." He says "thirty years ago probably not more than one-third of the English people consumed animal food more than once a week, now nearly all of them eat it in meat, cheese or butter once a day. This has more than doubled the average consumption per head, and when the increase of population is considered, has probably trebled the total consumption of animal food in the country. The increased supply has come partly from our own fields, but chiefly from abroad." The leap which the consumption of meat took in consequence of the general rise in all branches of trade could not have been met without foreign supplies, and these could not have been secured except by such a rise of price as fully paid the risk and cost of transport. In this way such an impetus was given to the breeding and growing of stock in the United Kingdom that in thirty years its capital value had increased from £146,000,000 to £260,000,000 sterling, or $1,300,000,000, an increase of £114,000,000, or $570,000,000. Bear in mind, too, that while England has thus developed her stock interests to a degree and with a success that has encouraged this business wherever stock can be profitably raised in the world, her lands have gradually improved and reached a state of fertility never before realized, so that in the last half century her yield of wheat per acre has nearly doubled. A similar result is seen in Germany. The meat and dairy productions of the German Empire have greatly increased in the last quarter of a century, and yet the soil has been producing larger and larger crops each successive year. The acreage under tillage is decreasing, and that devoted to grass advancing. Less acres tilled, but more grain because of enriched fields—more grass for more stock. To keep on cropping land and neglecting stock is to kill the goose that lays the golden egg. Where no oxen are the crib is clean, says Solomon; we may add the pockets of the farmers also.

And what is true of British and German agriculture is, to a certain extent, true of American. The live stock interests of this country are assuming proportions that make it to-day the leading factor in our agriculture, and I think I am not wrong in saying that this question of the profitable, the economical breeding and feeding of stock is one of paramount interest to a very large majority of our farmers. In the production of animal products the farmer is disposing of his surplus fodder, where the refuse will remain to enrich the soil and make the wastes good. He is pursuing a plan which, if supplemented with fertilizing agents, will maintain and even increase the productive capacity of his farm. Not that wheat tillage should be given up entirely, I do not advocate that for a moment; but I advocate less acreage, better culture, higher manuring, larger yields, better prices for what is raised, or at least more profit, and, in connection, such attention to stock husbandry in one or more of its branches as shall contribute, in approved ways, to the building up of the farm and make the investment of money in land more desirable because more profitable.

Another important consideration in this connection is the great saving in the cost of transporting animal products as compared with grain. Have you ever stopped to think that you can send eight dollars' worth of cheese or twelve dollars' worth of butter, or from two to three dollars' worth of beef, pork or mutton to New York or Boston as cheaply as you can send one dollar's worth of wheat?

WHAT ANIMALS TO FEED.

We have to-day breeds of cattle with distinctive qualities that have made them popular, and deservedly so, for certain purposes. Our native stock, so termed, is much of it more or less commingled in blood with these thoroughbred cattle, or their descendants, and I have no doubt that females could be selected from our native stock of grand milking and feeding qualities, and these bred to thoroughbred males, carefully selected to perpetuate and intensify the qualities we desire, will result in our securing such stock as can be handled and fed profitably. What I have said of cattle applies to other stock as well. A large majority of animals kept on American farms have not been selected or bred for any particular purpose. They are the result too often of accident, or the commingling of strains of blood that have no affinity for each other, that can only result in deteriorating the constitution and the qualities that make an animal of practical value. The importance of a careful selection of breeding stock can not well be over-estimated, but it receives very little attention from nine-tenths of the farmers of our country. It is a fact that inferior farming has no chance of success nowadays. It is all that good farmers can do to hold their own and realize something like a fair return on their investments, and in no part of our farming is this so true as in stock husbandry. It should never be forgotten that the most successful management of stock requires precise knowledge and a perfect acquaintance with details.

How few farmers take into consideration the annual milk product of a cow in estimating her value! A cow may give a large milk yield for a short time, and then fall off and go dry for half the year, and so be kept at a loss, while another giving only a moderate yield, but with a much longer period of lactation, would return a fair profit; but too frequently the verdict of the owner would be in favor of the poorer animal. How many animals are fed for the markets at a loss because they lack feeding quality—the ability to assimilate food so as to make good returns. How can this be remedied? Only by careful selection, by actual tests of the value of the milk for dairy products, if so used, and the keeping of accurate milk records. With these facts in hand, not guesses nor vague impressions, the breeder, the dairyman, can weed out from his herd such animals as are not up to his standard. By the proper management and breeding of his best he is on the sure road to improvement. He has cows that he knows pay a good profit on investment, food and care. This matter of selection is equally applicable to all classes of stock. Select the best from your herds, and do not be tempted to sell them by liberal offers.

ECONOMICAL FEEDING.

We have much to learn as regards the feeding of animals. Science has contributed some well-established principles that apply here, and in the light of these, a study of the relation of food to animal growth can not fail to be of service.

The old notion that the feeding of grain increased the cost of keep and production is no longer credited. Grain fed properly cheapens the cost of the increase in weight. As a rule, grain is as cheap or cheaper than hay for a part ration, and can be fed with greater economy.

But economical feeding means the proper selection and combination of the foods adapted to secure desired results. It embraces also the utmost regularity as to the time of feeding, as well as the quantity of food for each ration. A careful, regular feeder will produce better results with inferior food and animals, when they are fed promptly at equal times and in proper amounts, than an irregular feeder with the best food and stock.

Animal products, milk, beef, pork and mutton, are produced from the plants used for food. The animal is only the machine that transforms the nutrition in the food into these products. We see at once that if the food is lacking in the materials that produce milk or beef, for instance, the machine is without the proper material to do its work. The nutrition must be in the food, or the animal must go without it. It has been clearly demonstrated that it takes a certain amount of the food to keep up the animal heat—to maintain life and force for the work it must perform, and if we are only furnishing sufficient food to answer this purpose, in other words a maintenance ration, there can be no gain in weight, no increase in milk yield. In other words, we are feeding the animal without returns for food consumed. I may call your attention briefly to the two classes of materials of which foods are composed.

1st. The nitrogenous—those containing nitrogen, and usually termed albuminoids—embracing albumen, caseine and fibrin—a better name may be flesh-formers. All plants contain the albuminoids in greater or less degree. Growing animals need a large proportion of albuminoids in their food. These elements go to produce bone and muscle, build up the frame, and because wheat, bran, oats, oil meal and clover hay have a large percentage of albuminoids they are, as every feeder knows, the best food for young growing animals. Again, if you desire milk, rich in caseine, for cheese production, the cows should have food rich in albuminoids.

2d. The other class of materials is known as carbo-hydrates—the compounds resulting from the combining of carbon and oxygen. These maintain the animal heat, supply force, and maintain respiration. Starch and sugar enter largely into their composition. To feed economically we must combine these two classes of foods so as to give such rations as will be suited to produce the desired return.

If we give a young animal more carbonaceous food than is needed to support the system and carry on its functions, the animal will only lay up or make use of so much as is needed with the albuminoids required. In such case the animal is required to masticate and digest food that it cannot assimilate. It will not go to the building up of the animal, but is thrown off as waste material. So far as the animal economy is concerned, it has been an injury rather than a benefit. For a practical illustration of this statement, permit me to refer to an experiment reported by a celebrated German authority.

A cow had been fed for some time, per 1,000 pounds of live weight, with a daily ration consisting of 26 pounds of potatoes, 2½ pounds of oil cake, and 14 pounds of hay, without a change in her weight. As soon as one pound of oil cake per day had been added, her weight increased rapidly, and within 14 days she had gained 91 pounds in weight. The result, says the experimenter, cannot be satisfactorily explained by the mere increased consumption of the 14 pounds of oil cake, but it is reasonable to assume that the excess of starch, due to a too liberal use of potatoes, had been turned to a better account for the formation of animal matter—shown by the increase of live weight—in consequence of the addition of a rich nitrogenous article of food like the oil cakes. Instead of passing into the excretions of the animal, where it had been previously recognized, the starch now assisted in the bringing about of the increased live weight. The *physiological* value of the 14 pounds of oil cake exceeded many times their *commercial* value. The best results in feeding stock can only be secured by taking into the account both standards—the physiological and commercial.

The feeding effect of the same substance varies in different combinations. The practical knowledge of details and management needs to be supplemented by such knowledge of the elements entering into fodders as shall enable us to make the proper combination of foods, or, in other words, a well-balanced ration suited to the wants of our animals. This conclusion, while it may not be expressed by the feeder in these terms, is in harmony with his practical experience. How to combine our coarse, cheap fodder, straw, corn-stalks, hay, ensilage, with the more concentrated foods, as wheat bran, oil meal, corn, and oats, is the problem the thoughtful, progressive and, therefore, successful stockman is trying to solve. Such men in their study and practice are daily gathering the facts that throw light upon this important subject.

In this connection, permit me to urge the economy of fertilizing lands by the purchase of commercial foods for our animals, rather than by the purchase of commercial fertilizers for our fields. I am confident it will be found a more economical method of enriching land.

Judicious, common-sense feeding, that secures thelargest product at the least cost, is the basis—the most important factor in dairy husbandry. And by this I mean more than a knowledge of the chemical constituents of foods and of milk, more than a knowledge of the dairy breeds and the anatomy most likely to be associated with large milk production. Such knowledge is very desirable; but it must be associated with correct notions of the peculiar characteristics of individual animals, with methodical feeding, kind treatment, and the wise and practical application of all of these to the work in hand.

The more I see and study cattle and cattle-feeding the more I believe that good feeders, like poets, are born—not made. I shall not go wide of the mark when I say that the supply of such is not at all equal to the demand.

WHAT TO FEED.

I shall treat this topic from a Michigan standpoint, assuming that, for Michigan dairymen, in the main only such products as are grown in our State can be fed with economy and profit. For the summer season I should give the preference to old pastures having a variety of grasses. The experience of old dairymen is almost universally in favor of such pastures. The quality of the milk produced by them is much better and the quantity larger than that produced by the grasses of newly seeded lands. Good pasture grass—that is grass that is eaten a week after it is grown, is the most perfect food for cows in milk. The food elements are in right proportion and a large per cent of it is digestible.

Michigan dairymen, I fear, have not given as much attention to making permanent pastures as their value and importance demand. Besides being more palatable, on account of the variety, the grasses are more nutritious, and careful tests have shown that they produce more milk and beef at less cost than any other feed. The practice of laying by a good portion of the farm to permanent pasture, by seeding with a variety of grasses and clovers, may be safely adopted, by most of our dairymen. By frequent top dressing with manure such lands will become more productive and valuable as year succeeds year.

In addition to the pasture I should feed a small ration of wheat bran daily, increasing the amount when the pastures are short. Two considerations would induce me to feed the bran, viz., to secure an increased milk yield, and also the fact that its manurial value after having passed through the cow is equal to almost, if not quite, its first cost as sold in our markets. The pasture and bran may be supplemented by a piece of fodder corn sown in drills not too thick, which can be drawn upon in case of drought or other emergency. These are the foods upon which the Michigan dairymen can rely for summer feeding and not be disappointed.

The question of feeding for quantity and quality of milk during the winter season is more complicated, and will call into active exercise all the skill the dairyman possesses; because, as we have seen, his success in feeding will depend upon his judgment in combining the coarser fodders with the concentrated foods so as to make a good milk ration. Clover, old meadow and Timothy hay, corn stover, straw, ensilage and roots—these, in various combinations, with meal made by mixing equal parts of wheat bran with an equal amount of oats and corn ground together. These, properly mixed and prepared, will furnish profitable winter rations for dairy cows in our State.

We have seen that milk is a very complex fluid, containing all the component elements of the animal body. The food, therefore, to produce it should be rich in all these elements. Dairymen frequently make a mistake in supplying a ration from one kind of fodder, instead of giving a variety. Corn fodder is fed in large quantities in this State. It is good as a part ration, but is very deficient in albuminoids, which are found in so large a proportion in milk. It should be fed with clover hay, oats and peas, millet, oil cake or wheat bran.

ENSILAGE.

[Discussion at Fremont Institute, February 3, 1887.]

Mr. A. E. Upton: I would like an account of ensilage from Professor Johnson.

Prof. S. Johnson: Ensilage is fooder cut green and stored in that condition in an air tight compartment. Our last last crop of ensilage was grown on a sandy loam. Bailey's ensilage corn and Chester county corn were grown on the same plat, in rows four feet apart, dropped in drills and covered with hoes. It was cultivated four times with a one-horse, double-shovel cultivator. It attained a large growth, had a few ears, and had become a little brown at the butts of the stalks when cutting was commenced September 12. The filling of the silo being finished September 15, it was covered September 16 and weighted with one hundred pounds of stone to the square foot, laid over matched planking.

The area of corn put in the silo was 211 rods, yielding 46,763 pounds. The dried corn fodder was grown on an area of 64 rods, yielding when dried, 4,350 pounds. This would make the weight of ensilage grown on one square rod 221 pounds, or 35,360 pounds per acre. The yield of dried corn fodder per rod was 68 pounds, and 10,880 pounds to the acre. In other words, 3¼ pounds of ensilage make one pound of dried fodder.

The weight of corn in silo—weighed as it was put in September 12, 13, 14, 15—51,433 pounds. The silo was opened December 15, and each load taken out was carefully weighed and a record kept. Finished the feeding April 1, but a few cubic feet of the ensilage left in the silo at this writing, June 8, seems after the surface is removed, in a good state of preservation. The number of pounds weighed out was 44,315. This indicates a loss of 7,118 pounds, about 15 per cent. I estimate the loss in weight of the fodder corn by drying out in the barn about the same as ordinary hay, or from 15 to 25 per cent.

I have always found difficulty in drying corn fodder so that it could be stored without injury in large quantities. Here is one advantage in storing in a silo. If the work has been properly attended to, cover and weights on, you may be quite certain that the ensilage will come out in good shape. You will be saved the vexation of watching and turning your fodder, unbinding and binding, and seeking out new devices to prevent the fodder corn from moulding, which it is so likely to do. I am inclined to believe that the green corn can be cut and placed in the silo at as little cost as the fodder can be cut, dried and passed through the cutting box before feeding; and this, too, at a season of the year when the work can be more economically performed than in the winter. I know of no one who has tried it who is not pleased with ensilage.

Mrs. Hall: How large a silo would hold an acre's product?

Prof. Johnson: About ten feet square and eight feet deep. Ensilage ordinarily weighs about forty-five pounds per cubic foot. The whole of the corn, stalk, leaf and ear are put into the silo.

Ensilage should be fed in connection with grain.

Dr. Beal: A speaker at a farmers' institute in Wisconsin said that for $2.50 he could make enough ensilage to equal in feeding value a ton of clover hay.

Prof. Johnson: Corn ensilaged is worth more than it was before. Three tons of the ensilage is equal in feeding value to one ton of hay. The yield of ensilage corn was eighteen tons per acre, equivalent in feeding value in a combined ration to six tons of hay. Ensilage means the growing of an equivalent to six or ten tons of hay per acre. A silo for 100 tons could be arranged in most barns for $75.00.

Mr. ———: Could you arrange a silo by digging a hole in a sandy soil?

Prof. Johnson: Yes.

Mr. ———: Does it freeze when you open it?

Prof. Johnson: No. It must be under roof.

Mr. Robinson: What is the comparative cost and feed value of ensilage and roots?

Prof. Johnson: Food value equal and cost of ensilage much less. In filling we fill evenly all across the silo. It is not necessary to fill all in one day. I find four or five days may be taken. In opening I open a little at a time and cut with a hay knife.

Mr. Kingsley: How much do you feed at once to milch cows?

Prof. Johnson: In the Report of the Board of Agriculture for 1885, pages 100–120, full accounts are given. Six per cent of the live weight of an animal with grain would be a day's ration.

I need only add to my former report that experience confirms the statement then made that any material may be used in the construction of silos that will exclude the air; that it is better to have several silos, or divisions, rather than a very large one; that weighting with stone, barrels of earth, or sacks of grain is likely to be more satisfactory than a screw, which may not receive attention at the right time; and that the silo is one of the most economical methods of providing shelter for fodder. In no way, perhaps, can the same equivalent in dried fodder be secured with so little expense. Several silos were built in the State last year of wood, and I have yet to learn that any of them has proven a failure.

It is to be regretted that so many extravagant statements have been made in relation to the value of ensilage, the number of cattle that could be kept from the product of a single acre, etc. Practical, thinking men have been deterred from investigating this subject and giving it such attention as it really deserves, because of the wild statements of impracticable enthusiasts.

I am more than ever convinced that the idea I suggested two years ago, that ensilage will prove a cheap substitute for roots, will be approved by any farmer who will make the trial. Farmers who have had experience in feeding stock know how desirable it is to have some succulent food as a part ration, at least, during our long cold winters. Roots are a desirable cattle food but an expensive crop for the average farmer to raise and handle. But few farmers have the facilities for storing them in any quantity. They must be buried in the field; and in the winter, with the thermometer below zero, digging out the roots and getting them to the stock is not a pleasant task. If ensilage will give us the succulent food at less cost, in shape to be easily handled and occupying but a small space in storage, it must prove of value. What are the farmers in Michigan to do with the coarse fodders raised on our farms, but feed them? They are too bulky to transport to market—they must help make beef and mutton; but the farmer needs something to feed in connection with them to make them of more value, and the ensilage will help out in this direction.

The large number of silos erected during the last year in all parts of our country indicates that ensilage has the sanction of a number of our leading farmers, and that actual tests confirm reasonable claims as to its value as a cattle food.

The following discussion on the same subject took place at the Dairymen's Convention at Flint:

Mr. Moore: I would like to ask Prof. Johnson whether he thinks it takes more skill to make a silo than to raise clover hay?

Prof. Johnson: No.

Mr. Moore: When open, does the ensilage spoil or freeze?

Prof. Johnson: No; we take off the top weight on one side, and a few planks, and cut off, the same as a hay stack.

Mr. Rosecrans: How much more expense is it than to put up clover hay?

Prof. Johnson: Ensilage costs us $1.50 a ton.

Mr. Boyd: Do you get more butter from the use of ensilage than from the use of common foods?

Prof. Johnson: The quality is improved and we think the quantity is increased.

Mr. Power: In what stage of maturity do you recommend that the corn be cut?

Prof. Johnson: In the roasting ear.

Mr. Power: What variety of corn do you prefer?

Prof. Johnson: Any large dent variety, Southern dent preferred.

J. H. Monrad: Why do the milk condensing factories refuse to receive milk from cows fed with ensilage?

Prof. Johnson: It has been the policy of some writers and scientists to decry the silo, but from the fact that they are veering around to our side, I think their opinions are entitled to little consideration.

Mr. Monrad: I speak of this at this time to show that much of the opposition to the silo is based on the old process of preparing ensilage. That was emphatically a process which generated acid and mould, and rendered the ensilage very sour.

Prof. Johnson: The old idea was that the silo must be filled in a hurry—within a day or two. By taking more time to fill the silo, less fermentation results, so that now we have what may be called sweet ensilage.

Dr. Montague: Do you prefer ensilage to roots for milch cattle?

Prof. Johnson: Comparing ensilage with roots, I should say that the advantage is in favor of the former.

At the institute at Bancroft, Prof. Cook spoke as follows on this subject:

A silo is simply a tight box for the preservation of stock food, air tight, in a form in which it can be easily used by animals.

I know a man who says that he eats fifteen apples per day. Could he do that if the apples were dried?

Lawes and Gilbert originally objected to silos because they added nothing to the food, and merely retained a portion of its natural moisture. But there are several just claims to be made for ensilage.

1st. It is more digestible than dried fodder.

2d. It is an easier form in which to preserve and store food.

For ensilage, cut the corn with a reaper, one row at a time, one acre in two hours. Cut, not green, but at the same time that you would for drying; let it wilt on the ground one day; draw on trucks if you have them, and draw part at a time, two or three days apart, and cut into one inch pieces; put in when not too wet; cover with thick, heavy building paper, and then with a load or two of hay. A fair yield is 14 tons per acre; one ton occupies 50 cubic feet of space. A silo 14x15x16 will hold three acres' product; two tons of ensilage is equal to one ton of hay. This kind of food will make butter in winter. Mr. Gould says it takes two acres of hay to keep a cow, and the same amount of ensilage will keep eight cows. Ensilage costs $1.50 a ton.

Mr. Baird: Do you put the ears in?

Prof. Cook: Yes, sir.

Mr. Baird: Is the silo above ground or below?

Prof. Cook: No difference if properly drained.

Mr. ———: Won't freezing spoil it?

Prof. Cook: It won't freeze.

Mr. Baird: Do you cut it?

Prof. Cook: Some store it without cutting, but it is better to cut it, as less air is included.

Mr. ———: Does it need pressing in process of storing?

Prof. Cook: It is well to tramp it, but not necessary.

Mr. E. A. Burnett: Do they feed ensilage alone?

Prof. Cook: Yes, when ears and all are siloed, though bran is well to feed with it. It is excellent for sheep, hogs or any animals, and will keep way along into the following summer.

COÖPERATIVE CREAMERIES.

DISCUSSION AT FREMONT AND CHARLOTTE INSTITUTES.

Mr. S. B. Walker: What is the cost of a small coöperative creamery for a country neighborhood?

Prof. Johnson: Of course it depends altogether on how extensively the business is gone into. $1,200 to $1,500 for building, and $650 for apparatus would establish a small one.

Mrs. Hall: I would like to say a good word in this connection for Jersey cows. They live on one-third less than native cattle, and give a harder, better butter and more of it.

Mrs. McCallum: I have found cheese making far more profitable than butter making. I sent away this week 430 pounds of cheese, worth $57.50, @ 12½ cents per pound. We can make 2½ pounds to 3 pounds of cheese to one pound of butter the year around, and it averages 11 cents per pound.

Mrs. Hall: I wish we might, at this institute, learn something about making cheese. I tried it once and the result was more like a grindstone than like cheese. Small farmers cannot make cheese to as good advantage as they can butter.

Chairman Jewell: In New York they used to make enough cheese from a cow in one year to pay for her.

Mr. MaComber: Why does butter so often refuse to come?

Mr. Butler: The trouble is in the temperature. When the butter refuses to come, set your cream on the reservoir, back of the stove, and after it is warmed a little, it will come readily.

Mr. MaComber: I am always careful about the temperature, keeping it at 62 degrees.

Mrs. Hall: Salting the cows will help it. Sometimes a handful of salt put in the churn will help it.

Mr. MaComber: I salt my cows well and feed them grain, and all to no purpose. Sometimes the butter comes in fifteen minutes, and sometimes in three hours.

Lewis Reinoldt: I would be glad to have a creamery established near us for the sake of lessening the burdens which our wives have to carry, even if there were nothing else to be said in their favor. Farmers' wives have to work too hard and the care of the milk of the farm is a heavy addition to their burdens. I would be willing to take my milk several miles rather than have its care fall on the women at home. I would keep twenty cows for a creamery.

Mr. L. L. McCallum: I cannot afford to send my milk to a cheese factory as I need it for my young cattle, as it enables me to raise them in good shape, keep my farm up and in condition for mixed farming.

Prof. Johnson: What difference in value would you make between whey and skim milk?

Mr. McCallum: The skim milk is much the best, though with meal and whey you can raise good calves:

Mr. Hilton: Don't creameries generally leave the skim milk for the farmer?

Prof. Johnson: Usually.

Mr. Kingsford: I have known of a creamery that did not return the milk. They made skim milk cheese. I prefer creameries to cheese making.

Mr. Reinoldt: At Sparta there is a successful cheese factory, and Mr. Murray, the manager, says that farmers now keep 20 cows where they used to keep three or four.

Mr. Neil McCallum: I have no experience with cheese, but would favor creameries for the sake of uniformity in quality and consequent price of the butter.

Chairman Jewell: How is it, Mrs. McCallum, can the creameries beat you making butter?

Mrs. Neil McCallum: I think creameries can beat us in uniformity of product as Mr. McC. says. I make good butter but can get no better price for it than others who make poor butter.

Mr. Neil McCallum: I took some butter lately to Muskegon, where it sold from 16 to 20 cents and retailed from 25 to 30 cents.

Mrs. Hall: There is a creamery at Whitehall and when we can get but a shilling they get 20 and 25 cents. At Whitehall each family has a small creamery at home. The cream is weighed when taken from the houses and the farmers say they are making a good thing of it.

Mr. Jno. Brotherton: I don't think butter pays at present prices and would be glad to see a creamery or cheese factory started here. If neighbors club together to make cheese I believe there is more money in it than in butter. I would increase my stock of cows in such case.

Dr. McNabb: I approve of the creamery idea to abolish this nuisance of churning at home. I took my first lesson in swearing at that business—not aloud, because I would have got licked.

Mr. Wilsey: Having a creamery or cheese factory involves a large increase in the number of our cattle; and feed will have to be found for these additional animals. Can any one here give figures of cost of keeping these cattle and the relation of that to the proceeds. What is the cost of wintering, the cost of pasturing, the cost of marketing, etc., and what is the profit left? I find cheese much more profitable than butter.

Dr. NcNabb: I think it takes no more fodder to keep a big animal than a little one. I can sit down at table with a great big man and eat three times what he will.

Prof. Johnson: Cheese now brings eleven cents per pound, and butter carefully made and sold brings twenty-five cents, and it is true that a given quantity of milk will make two and one-half times as much cheese as butter. I think that part of the low price for dairy products is due to lack of care in marketing. At these figures, and calling skim milk worth half a cent per pound, the point is in favor of creameries instead of cheese making, especially considering that the former takes the labor out of the family. As to profit and loss account of stock raising. Is it not better than wheat raising? Winter dairying would be profitable. More of our cows should be in milk in winter. The home market for butter, etc., should be developed.

At Charlotte Mr. Nye said: We have tried a creamery one season. Ice gives an additional advantage of one-third to one-half, by giving a uniform temperature so that you get more cream. The cabinet creameries are the best, but they are too expensive for most farmers. Milk should not be chilled too suddenly. A creamery provides ventilation. This is very necessary. It keeps an even temperature, more so than tanks in winter. In our house we set in pans; that plan is better where women do the work, as cans are too heavy. I don't know the average price of cream, but from April 19th our cows paid us over $18 apiece for cream. The price in April was 20 cents per gauge. If cream is raised with ice one gauge gives one pound of butter. If with water one gauge gives more than one pound of butter, *i. e.*, we get more and thinner cream by using ice.

Mr. Hallenbeck of Vermontville: We skim into the churn and let it stand in cold water 24 hours. Then add a teacupful of old buttermilk to four gallons of cream; heat to 80° till slightly acid, cool down to 62° and churn. By that method I can get butter in 15 minutes. At 50° I would have to churn an hour.

Mr. Childs: I have had one season's experience selling to a creamery as follows:—

April, one cow from the 9th and two more from the 16th gave 51 gauges of cream, part of the time at 20 cents and part of the time at 15 cents per gauge	$9.50
May, three cows part of the time and four cows part of the time	19 50
June, four cows, 145½ gauges at 12 cents	17.47
July, “ “ 110 “ “ 12 “	13.19
August, “ “ 108¾ “ “ 12 “	13.05
Sept., “ “ 108.1 “ “ 15 “	16 22
Oct., “ “ — “ “ 16 to 18 cents	16.00
Nov., “ “ 13 days “ “ 18 cents	10.00
Total at an average of 14½ cents per gauge	$114.93

Mr. Hollenbeck: I got five gauges per day at 18 cents per gauge from the creamery, when by making my own butter I only got 65 cents per day.

Mr. Shipman: I tested the matter for a week and thought I could do better than selling to the creamery.

Mr. Stahl: For one season I collected the cream for a creamery from 300 patrons. Two-thirds of the patrons were pleased and thought the system profitable. There were 760 calves raised by the patrons on the skim milk left after sending the cream.

Dr. M. Miles: There is a great difference in breeds in the quality of milk and size of cream globules. Even individual cows vary greatly in the quality of milk, and the treatment that will produce the best results from one cow's milk may not produce the best from another. You need to keep constant watch, constantly testing and selecting.

Mr. Bradley: As I have dealt some three years in cows and milk, I have tested milk somewhat. I don't know the breed of my cows unless they are the same as the dung hill fowl. Last spring I tried selling to a creamery. On the last five days of April I set 711 pounds of milk, which gave twenty-one and five-eighths gauges at fourteen cents=43 cents per hundred pounds of milk, which was a poor return compared with cheese factory profits. My milk only gave one gauge to thirty-three pounds of milk. I set 150 pounds of milk in pans and got six and three-quarters pounds of butter which, at 16 cents per pound, for butter, would be 70 cents per cwt. for milk. I then set 154 pounds of milk in cans and got four and a half gauges of cream, which made six and a quarter pounds of butter. I found no particular difference between cans and pans. I patronized a creamery twenty-one days in April and May, and after that sent my milk to a cheese factory and got eighty cents per cwt. in May and June, and $1.00 per cwt. in October. I consider that 25 per cent better than making butter or selling to a creamery.

THRESHING CORN.

Dr. Beal: I would like to ask Prof. Johnson about threshing corn.

Prof. Johnson: To thresh corn it is necessary to be very careful to thoroughly cure the corn in the field to prevent heating.

Mr. Hilton: I saw the process. The cylinder of the thresher was raised and half the teeth removed from the concave and cylinder. A friend said that it was worth threshing if only for the effect on the fodder, as it made better bedding, better for feeding, and better, (because more easily handled) manure. The machine threshed 135 bushels in half a day.

Mr. ——— : I saw a statement that an acre was threshed in two hours.

Dr. McNabb: I have husked corn and like the crop better than any other, but husking and shelling corn is hard work, and I should think it might be threshed. My only objection to the plan is that it destroys the symmetry of the cob.

CONDENSED MILK.

BY MR. EWING.

[Read at the Charlotte Institute, February 17, 1887.]

Mr. Chairman, Ladies and Gentlemen—While we attempt to present the merits of this infant industry, we wish to do so from the stand point of a farmer, and view the question as a business enterprise, that we may compare our views and experiences, and thereby benefit ourselves and attain a maximum degree of profit.

Condensed milk has been used more or less for the last thirty years; first in France, and to supply the place of milk in localities where it could not be had, being largely in demand for armies, navies, etc., but science and experiments have improved the process, and consequently the product, until now we find it in use in large cities where the local milk man's dilutions of water and chalk have become unsatisfactory and a genuine article of condensed milk meets with much favor, and in the Southern States where milk will not keep fresh, and where ice is expensive we find that orders for condensed milk are large. One dealer in Atlanta gives the Lansing factory orders for car load lots, and the demand is constantly increasing in various ways, as food for children and a substitute for adulterated syrups on pancakes and in cooking fancy cakes and confections.

The milk for the manufacture must be pure and free from odors, such as from roots, turnips and carrots especially, and the milk cooled as soon as possible allowing the animal odor to escape and not take up the odors of vegetables or of the kitchen. After it is cooled to 60 degrees or lower, it is put in ten gallon cans and conveyed to the factory with teams, each team making a trip of twelve miles or less, as the case may be, gathering the milk on the route to the factory; there it is weighed and credit given to each person, and a statement of the weight, price and amount with the cash, is placed in an envelope and sent by the teamsters to each person who sends milk once each week, the price paid being $1 20 per hundred pounds, from the 10th of December until the 10th of April, $1.00 from the 10th of April until the 10th of June, $0.80 from the 10th of June until the 10th of September, $1.00 from the 10th of September to the 10th of December, making an average of $1.00 for the year.

When the milk is weighed it is strained into a cool vat, 33⅓ per cent of pure cane sugar added, and then pumped into an air tight copper globe which is furnished with coils of steam pipes inside to do the heating, with a condenser at the top and two heavy plates of glass for the operator to watch the operation. There is attached to the apparatus two heavy vacuum pumps adjusted to draw about 24 inches vacuum. When each batch is brought to the proper density it is run into large cans to cool, and then placed in a can-filler whence it is put into one-pound cans, soldered tight, labelled and cased for shipment.

There are but few of these factories in the United States, the main ones being located at Elgin, Ill., Brewster, N. Y., and Lansing, Mich. The Lansing factory is now a stock company, and known as the Michigan Condensed Milk Company, with a paid up capital of $100,000. There are some points of merit in connection witn this business that have induced many farmers to give their attention to the production of milk for it. First, it furnishes a steady market for milk all the year. Second, it gives quick returns for the labor and capital invested. Third, no labor in the house but to wash the milk pails.

Milk from Holsteins and Ayreshires is more desirable for condensing than that from Jerseys, as the globules of the latter are large and easily broken. Milking should be regularly done. Milk should be cooled as soon after drawing as possible. Ice is of great value in this respect. The importance of this point is often lost sight of.

Carrots fed to cows will give milk a peculiar flavor—also other roots.

Dr. Miles: That depends very much on how the roots are fed. If they are given immediately after milking they will not affect the flavor of the milk at all, whereas if fed before milking they will flavor the milk.

Mr. Ewing: Oats are much better milk-producing feed than roots in my view. I am now milking nine strippers, of which seven are three years old, and the nine give an average of fifteen pounds of milk on oats and hay. Eight quarts oats per day, say four quarts twice each day, and one feed of ground feed, shorts, bran, etc. If a cow inclines to get thin, add more corn meal.

Dr. Miles: A variety of food is desirable and will be most profitable.

Mr. Banks: It is said that throwing cold water into milk, facilitates the rise of cream. I believe the effect is due to the cooling. The more rapidly you cool the milk the more cream you will get, and the quicker you will get it. In summer I keep my creamery down to 43° and in winter to 38°. You can't get it too cool without freezing it. In summer when there is much rain milk is thinner.

Mr. Claflin: What creamery do you use?

Mr. Banks: Champion. I can draw out all the milk without touching the cream.

Mr. Claflin: Does the larger quantity of cream gained by cooling give you more butter?

Mr. Banks: I don't know. I think probably the cream from milk that is not so cold is thicker because it is longer in rising and so evaporates and thickens.

I find too much corn produces inflammation of the udder, but doubt if you can give too much oats.

Mr. Pancost: I use the Champion creamery, and have grade Jerseys. In summer my milk is one-fifth cream and in winter it is one-fourth cream. I put water in the milk as I think the butter globules come to the surface more readily from the thinner fluid.

JERSEY CATTLE AND PLEURO PNEUMONIA.

DISCUSSION AT THE HANOVER INSTITUTE.

President Willits: Are imported Jerseys more liable to pleuro pneumonia than others?

Mr. Dean: No, sir. It is unknown in the Channel Islands, and has existed in no imported animals. There has been less among Jerseys than among other breeds, and I think no one breed more susceptible than others. Jerseys are as hardy as others and are kept advantageously in Canada. This late attack of pleuro pneumonia came from one Jersey heifer in Ohio. They had had it for years in New Jersey and the region about Washington, and this particular heifer had been brought from the infected district near Baltimore.

I think for the ordinary farmer the Short Horn and its grades is the best general stock, but I think every farmer who wants butter on his table, or has grocery bills to pay, would do well to have one or two Jerseys to meet the occasion.

Mr. Wetmore: I used to be prejudiced against Jerseys, but once bought a grade bull and soon found that two-year old Jersey grade heifers were way ahead of my seven-eighths Short Horn old cows, and I found the same experience among my neighbors.

Mr. Dean: I find wherever there are grade Jersey heifers the farmers wont sell them for any $25, nor much, if any, under $50.

President Willits: Will Prof. Grange tell us something of pleuro pneumonia?

Prof. Grange: It was first described one hundred years ago, though it doubtless existed long before that. It attacks no animal except cattle, and of them only the lungs. As a rule the pleura is first affected, and afterward the lungs, producing a liver like quality, with a whitish membraneous substance interlacing it. I can see no difference between breeds in susceptibility to this disease. The disease has never appeared in Jersey; indeed, it cannot, because of the law against importing live animals.

It was first introduced in this country by a Short Horn, then by a Friesian, and later by an English cow not a Jersey.

Question: How is it communicated? by the breath?

Prof. Grange: It is hard to say. It has even been suggested that the germs may be carried in clothing, and I would think well to exclude visitors from the quarantine slaughter-houses. The disease begins with rigors followed by fever, the temperature rising to from 102 to 106, the natural temperature being from 101 to 102. Subjects become much emaciated, exhibit pain on applying the hand to the center of the back or tapping fingers on sides of chest. The lung is gradually converted into a liver like condition, making extra work needful to the remainder of the lungs, and this can be observed by the louder sound on listening at the chest. It is contagious and never sporadic. The disease incubates in from two to six weeks, and runs its course in from a fortnight to three months. There is a question whether complete recovery ever takes place, though aconite and turpentine have been administered with ameliorating effect.

Senator Sherwood: Are the symptoms so plain that anyone could recognize it?

Prof. Grange: Hardly. It resembles Texas fever in some respects and in a given case without knowing the history of it I would hesitate about pronouncing an opinion. Texas fever does not affect the lungs.

Prof. Willits: I will say a word or two of my visit with Prof. Grange to Chicago to see their management of the difficulty. You know Sheridan says the only good Indian is a dead Indian, and so we say that the only good pleuro pneumonia patient is a dead one. There are now before Congress laws for the settlement of this matter, but the question of jurisdiction and States' rights is making trouble, and there seems to be doubt whether an efficient law will be adopted.

Prof. Grange: I saw 140 animals slaughtered in Chicago, all grade Short Horns; one of them, the owner said, seemed to have had the disease before and to have recovered. On killing it a cyst was found in the lung which was liable at any time to break out again and spread the disease among fresh animals. So there is no safety in any case that has once had or been exposed to the disease.

Question: How about disinfection of such animals?

Prof. Grange: I do not know how it could be done to any purpose. In the case of the cow mentioned I could not have told from an examination, during life, that she had pleuro pneumonia, though I might have been able to say she had some lung difficulty.

Question: Is there no cure?

Prof. Grange: One of the greatest dangers is from the cases of apparently complete recovery. Cysts still exist in the lungs ready to break forth on provocation. The only thing to do in such cases is killing the affected animals and all others that have been exposed. Cattle are not subject to glanders. Cattle with pleuro-pneumonia generally do not stand up. With any lung troubles cattle lie down and horses stand up. A horse under such cases has to stand up to breath, while cattle with lung troubles breathe better lying down.

Mr. Dean: The question is asked as to manner of communication. A friend in Peoria sold an animal from his farm that had spent a single night in the same stable with a cow which afterwards gave evidence of pleuro-pneumonia, and this animal from that one night's occupancy of the same stable with a cow, which at the time had shown no illness, took the disease and carried it to Missouri. In Quebec, in order to stamp out an outbreak, they killed all exposed animals, and burned all the buildings, the clothes of the men connected with the operations, and even the top eighteen inches of the soil, and yet it broke out again afterwards.

President Willits: In these Chicago slaughterings they judged of the condition of the carcass by feeling of the lungs. If it was like liver in feeling, the animal was affected. Some times there would be but slight traces—the mere beginnings. There is no half way business in the matter possible. Congress is quarreling over the question of voting $1,000,000 to stamp this thing out. They might better give $10,000,000 than to have it spread.

Prof. Grange: As to eating the meat of affected animals. It is ordinarily not dangerous unless in the acuter cases and in the later stages of the disease, and there have been no cases of illness among human beings traceable to the use of such affected meat. Eighteen thousand people in France were fed on meat from diseased animals (pleuro-pneumonia) and no ill effect resulted. In the Chicago quarantine, of thirty-two animals slaughtered, thirteen were affected and but two were condemned for food.

CONTAGIOUS DISEASES—PLEURO PNEUMONIA.

DR. MANLY MILES, OF LANSING.

At the Charlotte Institute Dr. Miles spoke on the above subject, and from his remarks the following notes were taken.

Our knowledge with regard to the contagious diseases of our domestic animals has very largely increased of recent years.

We used to rely upon quarantine as a sufficient defense against them in all cases, but now we often find the most rigid quarantine of no avail.

We have to call in science to our aid. Experience is a good foundation, but science marks out the road for experience to follow. The two must go hand in hand and be mutual helpers. Science sets up the guide boards and practice finds ways and means of following.

These sciences have aided as greatly in solving the *why* of success, and so enables us to select the causes of success and avoid the causes of failure.

The microscope has among scientific aids done as much for us as any one instrumentality; and this chiefly in the line of the study of microbes. It is remarkable to what an extent this study of micro organisms is giving light in what have been hitherto dark directions. One of the most familiar forms of this germ life is seen in the common beer yeast. The fermentation in beer and in the yeast of bread is caused by the multiplication of the yeast plant. This appears on examination to be a mere cell which multiplies by budding out new cells. These cells are of different forms in different portions of the yeast. In high yeast the cells are nearly circular, and thrive best near the surface of the fluid, while in the lower portions of the fluid a more elongated form thrives best. In some cases yeast cells are very much elongated—even four times as long as broad.

Even in these low forms of life the law of the survival of the fittest prevails with the same force as among higher beings. The individuals that are best adapted to the circumstances in which they are, will live and multiply and crowd out of existence those which are not so well fitted to their surroundings. They are affected by temperature, by the density and quality of the substance in which they are and in short, just as we are, by all the conditions to which they are subject.

Commercial yeast is made up largely of high and low forms with a little of several other forms. In making bread if you give the conditions for high or low forms they will grow, if for neither of them, then one or the other of the various other forms will probably grow. These long forms multiply by division with exceeding rapidity. It is estimated that if there were nothing to check their increase, a single individual, $\frac{1}{20000}$ inch in diameter, would by reproduction fill the ocean solid one mile deep in five days. Some forms are useful, others harmful. We could not live without some of them. Pasteur found that acetic fermentation, lactic fermentation and butyric fermentation are also due to similar growths. Some are similar in form but different in action. Anthrax, a fatal disease, is caused by germs which multiply by fission and by spores, the latter being harder to kill than mature forms. Pasteur found that these are capable of a sort of attenuation by which a mild form of disease could be given which would protect from severe types. So Pasteur studied the silk worm disease and found a similar cause and a remedy. Tuberculosis or consumption is also similarly caused. The difficulty in studying these forms is increased by the fact that besides being so minute they are transparent, but we are able to make them visible by staining. These facts explain the communicability of consumption. A single germ if it finds favorable conditions for development can convey the disease. Exposure or overexertion may lower the vital powers of man so that they are unequal to resisting the development of the germs. Hydrophobia similarly is a germ disease, but the microbe causing it is so small and transparent as to be exceedingly difficult of detection.

Animals have long been known to be dependent upon plants for life. They can not eat soil. It must first be assimilated for them by plants. It is debated whether these microbes are plants or animals. I think they can hardly be classed with either. They can take nutrition from the organic or the inorganic world. Late researches indicate that as animals depend on plants for development of their food so plants depend on these minute forms for their food from inorganic forms. That nitrification is caused by one of these Schloessing and Müntz have proved. They found that vapor of chloroform would put a stop to nitrification and that the addition of fresh soil developed nitrification again.

They took soil all right for plants except for lack of these organisms and the plants would not grow.

Bacterium termo is developed by putting meat in water twenty-four to forty-eight hours, when putrefaction begins. Bacterium termo is very small, shaped like a dumbbell, and has cilia extending from each end which are the $\frac{1}{250000}$ inch in diameter. It is one of the best friends of man by breaking down used-up tissue and rendering it useful again.

Pleuro Pneumonia, Anthrax, Glanders, etc., are caused thus. How are they to be prevented? By understanding the habits of and finding what will kill these germs. Some of them may be killed by a proper change in temperature.

The best authorities say that quarantine is no use against Asiatic cholera. It won't stop it. Perfect sanitary conditions are our best defense. There must be no filthy breeding places for germs; sewers, sinks, barns, must be kept clean. I don't know what remedies can be found.

As to quarantine, hog cholera appeared on a farm where no outside contact or proximity to road could be proved, but the owners had got swill from a family which ate pork brought from Chicago.

So Pleuro Pneumonia can only be fought by killing every suspected animal. What if it costs $500,000? What of it? It must be stamped out if it takes every animal we have. No doubt must be permitted to save an animal. We need to study these organisms.

Peach yellows and pear blight can only be fought by extermination of affected specimens.

THE HORSE'S FOOT.

BY PROF. E. A. A. GRANGE, V. S.

[Read at the Institutes at Hanover, Three Oaks, and Bancroft.]

MR. PRESIDENT, LADIES AND GENTLEMEN—I have selected for discussion to-day "The Horse's Foot," a subject of vast importance to all who are engaged in horse traffic, be they breeders, dealers, or casual owners, and trust some facts concerning its structure in health and disease may prove interesting and instructive.

To begin with, let me say that I define the foot of the horse as being the part of the animal embraced by and including the hoof, which parts are invariably described by anatomists under two heads.

The outside (the hoof) is called the insensitive or inorganic part, because it has neither nerves nor blood vessels entering into its composition; it has no feeling and is no doubt intended by nature to cover and protect the highly organized and delicate structure underneath, in a manner similar to which the common boot protects the foot of the wearer; while the inside structure is abundantly supplied with both nerves and blood vessels, so much so that I have heard it called the quick (living part); to this anatomists give the name of sensitive or organic structure.

THE HOOF.

I will take up first of all, in brief detail, the outside part, or hoof, and of its form may say that it has been compared to the segment of an oval opened at the back, but I have often seen what I considered a typical foot in the colt, before it had been altered in shape by the desires of an exacting master, and the impression I received was that its shape resembled a truncated cylinder, so that its ground circumference would leave the impression of the segment of a circle rather than an oval. The truncation, or cutting away of the ground surface, is usually sufficient to produce an angle of say 45 degrees between it and the front surface of the wall.

The hoof is divided into wall, sole, and frog, which may be separated by maceration (soaking), sometimes taking a good while.

The wall, the part we see when the foot is on the ground, is composed of horn fibers which grow parallel to one another from above downwards, and are worn away by attrition at the bottom. They are formed or secreted by a spongy-like pad at the top of the hoof, and I believe the rapidity with which they are secreted is, to some extent, in direct ratio with the wearing away of them at the bottom, and am therefore of the opinion that the unshod hoof will grow quicker than the one whose lower border is protected by a shoe. The wall is divided for the convenience of description into toe, quarters, and heels; it has at its upper border a well marked groove, which is studded by numerous minute pores, in which are lodged the terminations of the blood vessels that pour out the horn substance. In the front feet the toe is the thickest part of the wall, say one-fourth to one-half an inch, (the hind feet are not usually so thick); the wall becomes gradually thinner towards the heels.

The quarters are the parts between the heels and the toe. The bars are inward inflections of the wall, which, besides strengthening it, appear to me to be the calks nature has provided to prevent slipping.

The laminæ, on the inner surface of the wall, will be found a most remarkable arrangement for attaching the hoof to other parts, consisting of several hundred plates of horn, the "insensitive laminæ."

The sole is that part of the foot embraced between the bars and the wall. The ground surface of it is concave and generally covered with exfoliated flakes, exfoliation being the process by which nature removes the superflous horn in this part, and not by attrition as in the case of the wall. The upper surface of the sole is convex and studded in every direction with innumerable minute pores for the reception of the blood-vessels from which it grows. The outer edge of the sole is dove-tailed into the wall in such a manner as to make the point of union very firm.

The frog is the prominent triangular part occupying a chasm of the same shape between the bars. It is a very important part of the foot and presents for consideration a cleft, two commissures, toe, heels and two surfaces, which may be referred to again. Proceeding from the heels of the frog, passing upwards and around the top of the hoof, is a structure thought to be for the purpose of protecting the new horn, when it grows, and called the "coronary frog band."

THE INTERNAL STRUCTURES OF THE FOOT.

These are called sensitive, because they are very highly organized, possessing an abundant supply of nerves and blood-vessels. The deep seated tissues of the foot are composed of several structures which differ considerably from one another. In the first place we have the coronary substance, one of the most vascular structures of the body, situated in a groove at the top of the wall, which it secretes; immediately underneath the coronary substance we find the sensitive laminæ, composed of say 500 or 600 plates formed largely of blood vessels and nerves. They, together with the insensitive laminæ, form the principal bond of union between the hoof and the leg and, being to some extent of an elastic nature, they modify that concussion, the result of forcibly bringing the foot to the ground. They are the seat of one of most painful diseases that horse flesh is heir to, "Laminitis or Founder." Passing around the ground border of the laminæ and turning the foot we come in contact with the sensitive sole, a beautiful structure, highly organized and composed of hundreds of little processes very delicate and velvety looking, so much so that they are called villi. They are the terminations of blood-vessels and the point where the horn for the insensitive sole is supplied.

The sensitive frog is a very tough and elastic cushion situated above the horn frog. It is composed of innumerable fibers interlacing one another, and embracing fat in their meshes. It is a pyramidal shaped body, having its apex projecting towards the toe of the foot. The use of this organ is to protect the navicular bone and tendon passing over it, as well as to modify concussion to the other parts of the leg.

The lateral cartilages are plates of gristle situated behind and above the frog, intended, according to my conception, to act as springs and thus throw the fatty frog into its natural position after it has been distorted by the weight of the body, spreading it in various directions. They are converted into bone in a disease called side-bone, which is a cause of permanent lameness in fast driven animals. It is of but little harm to walking horses. The disease is an incurable one, though it is frequently helped by neurotomy, or the division of the nerve by cutting above the seat of difficulty.

HORSE SHOES.

Supposing then that we have a correct idea of the natural or healthy condition of the foot, our next great object is to keep it so, and for this purpose implements familiarly known as horse shoes are much used. These are articles of very ancient origin, having been used in one form or another from time immemorial, until now their use is universal. We might ask ourselves what are they applied for? To which question there may be four answers.

1st. To prevent too rapid wearing away of the wall.

2d. To impart action to roadsters.

3d. To afford a grip for draught-horses and prevent slipping.

4th. For pathological purposes, when they modify the evil effect of certain diseases.

In shoeing but little of the sole should be pared away. The knife should never do more than remove worn out structure, that is, that which has begun to scale off of itself, and should never be allowed to cut the fresh, healthy substance of the frog or sole, and the walls should only be pared to a level with the sole. To pare the sole till it can be deflected by pressure of the thumb is all wrong.

The "heels" should never be spread or cut as that causes "contraction of the heel," which, though not producing lameness, is unsightly.

Shoes should have the upper surface flat, not beveled. A flat shoe on a hoof that is pared flat excludes filth.

Any beveling of the shoe should be done on the under or ground face, and here beveling has the advantage of lessening the likelihood of balling or of picking up stones.

The bearing of the shoe should be on the forward part, otherwise corns will result.

DISEASES.

Prof. Grange continued with a description of the disease of the horse's foot known as laminitis, of which a full account will be found in bulletin No. 25 on page 166 of this volume.

Mr. —— : Will you please tell us what thrush is?

Prof. Grange: Thrush is an inflammation producing suppuration in a small gland in the center of the fatty frog. It is caused by standing in a wet stall or in marshy places. If it continues unchecked it may destroy some of the structure, but it rarely causes lameness, and the inflammation rarely extends beyond the fatty frog. It is only likely to give trouble in case the discharge of matter is dammed up. It is more frequent in the hind feet than in the front feet. The remedy is to wash out and dust the sore once or twice with calomel. In case of much granulation a cautious person might use butter of antimony.

Mr. W. J. G. Dean: Do you approve of the application of hot shoes to the hoof?

Prof. Grange: If done with moderation it shows how the shoe bears on the foot and need not be harmful. Of course it can be put on so hot and held so long as to dry out the hoof and cause it to crack.

Question: Should the blacksmith rasp the hoof to clinch the nail?

Prof. Grange: There is no necessary harm in the practice and it makes a better looking job.

Question: Can the diseases of horses be inherited?

Prof. Grange: Certainly, many if not all of them. Ring bone is an inherited difficulty often occurring in colts and yearlings. It is a growth of superfluous bone. It is commonest in horses in which the pastern is very upright as in such cases there is greater concussion. Chestfounder is not apt to be transmitted by inheritance.

Mr. Wetmore: It used to be a practice to treat ring-bone by lifting or separating the skin from the bunch under it, and that would cause the bunch to subside.

Prof. Grange: That often appears to take place after the two bones have united. After the joint becomes affected I should consider the disease incurable.

Question: What is coffin-joint lameness?

Prof. Grange: It is the playing of the flexor pedis over the bone that acts as a pulley block. It is a disease common in roadsters and rare in draft-horses. Often caused by working horses too hard. It is the result of a strain or else it is inherited. In the former case it begins in the tendon, in the latter case it begins in the bone and it is then more difficult to cure. Symptoms of lameness often appears after shoeing, disappearing in a couple of days and reappearing in a month or so again or when re-shod. The animal when starting after standing a half hour goes lame at first. In chronic cases the toe of the shoe is particularly worn, the animal standing with one foot in front of the other. A frequent secondary effect of the disease, resulting directly from non use of the foot, is atrophy and shrinking of the foot and of the muscles at the shoulder.

Treatment to be of any use should be given before the case becomes chronic. First, poultice for two or three days. Second, blister the coronet and then turn the animal out onto soft pasture for a couple of months. For a chronic case neurotomy is sometimes successfully practiced. The nerve runs along the front edge of the back tendon on each side and may be cut by making a vertical slit in the skin at this place a few inches above the pastern. An artery and a vein are in close neighborhood, the former distinguished by a pulse the latter by its color. The nerve if pressed will make the leg twitch. Cut at top of incision first and then at bottom.

Question: Is coffin joint lameness ever caused by fast driving and sudden chilling?

Prof. Grange: No; not from the latter certainly, though it might be from a strain incident to the fast driving.

Mr. ——: I had a very nice horse ruined by fast driving and sudden cooling.

Prof. Grange: It may have caused laminitis but not coffin joint lameness.

Question: What do you think of having horses go barefoot?

Prof. Grange: It is often an admirable practice. Where the roads are not too hard the animal will probably fare better than if carelessly shod.

Question: Would permanent injury be caused by allowing farm horses to go barefoot till tender?

Prof. Grange: No, sir; a soft pasture will remedy the tenderness.

Question: What causes corns?

Prof. Grange: A corn is properly a bruise of the sole, though a bruise of any part of the foot may be called a corn. Wearing a shoe that is too small, having the shoe slip on the foot or wearing a shoe too long without resetting may cause a corn.

Question: How long should a shoe be on before resetting?

Prof. Grange: Perhaps six weeks.

Question: What will cure a shoulder gall of long standing?

Prof. Grange: Excision.

SHEEP HUSBANDRY.

BY S. C. TARBELL OF KALAMO.

[Read at the Charlotte Institute, February 17, '87.]

Mr. President, Ladies and Gentlemen:—The first step to be taken by him who courts success in sheep breeding is to set up a standard toward which every effort shall be directed. The good old days are gone forever when everything that had wool passed muster for a sheep. *Breed for some purpose.*

WOOL OR MUTTON?

If you are far removed from the great central markets for meat you must necessarily invest a large percentage of the carcass in freight charges. You should bear in mind the fact that a pound of wool represents the price of many pounds of mutton, and let your efforts be directed to increasing either the quality or weight of fleece regardless of the effect which such selection and breeding may have upon the carcass.

But, upon the other hand, the farmer who is so fortunate as to be located within easy shipping distance of some of our large cities may have something more than weight and quality of fleece in view. The sale of early lambs or fat wethers may prove more profitable than the sale of wool.

The careful breeder studies the needs of his flock. It is not necessary to support a 200-pound sheep to carry around a five pound fleece of wool, and where mutton does not bring good paying prices it is not advisable to furnish feed for heavy sheep that yield a light fleece. There is far more profit for such to breed Merinos weighing 100 pounds a piece and yielding from ten to fourteen pounds of wool than to support the carcass of the larger breeds.

I am not much of an advocate of this patent medicine, good for every-purpose idea in breeding any kind of farm stock. A little careful study ought to convince any man which of the two, wool or mutton, will yield him the greatest profit, and having made his selection, use every effort to accomplish the purpose in view.

BREEDING.

The farmer who keeps sheep should not be led by any false notions of economy to use anything but a thoroughbred sire in his flock. If he happens to own a flock of the common sheep of the country, the use of a well-bred buck is much more imperative than with high grade or thoroughbred ewes, for nowhere else will a well-bred sire give such evidence of his power to transmit his characteristics as when bred to the common stock of the country.

It is surprising and a trifle mortifying to the breeder that, of two pure-blood Merinos with unquestioned pedigree, one will yield a light, dry fleece scarcely weighing four pounds, while another will turn off a fleece of great bulk sufficiently furnished with yolk, and weighing from ten to twenty pounds. Pure blooded sheep will do this, but well-bred sheep will not, and any flock which presents such radical differences argues remissness in the owner's habit of selection.

LAMBING.

The critical periods in sheep husbandry are at lambing and shearing time. The old fogy idea, persisted in to-day to a large extent, of having lambs dropped in May and June, is to be deplored. Those who have given the business attention know that lambs dropped in February and March make larger sheep, and the per cent lost is much less than when dropped later in the season. At this season of the year sheep are, or ought to be in the barn and yards where they can be attended with very little trouble. It is also at a time when other farm duties are not pressing. It is good practice for those expecting early lambs to be provided with flannel blankets large enough to cover a young lamb, and should the weather be very cold, tie on the blanket and help the lamb to its first dinner and it will not require any special attention afterwards. The ewes should be provided with plenty of clover hay and a slop of wheat bran twice a day. There is not much objection to a grain ration being given once a day, although I do not practice it.

SHEARING.

To those who wash their sheep I would advise having it thoroughly done in clean water. Washing in muddy water destroys the luster of the wool, and gives a dingy appearance to the fleece. Carelessness in washing is the main cause why so many farmers are obliged to sell their wool for less than the market price. There is no other product of the farm that is as closely inspected by the purchaser as the wool crop.

At shearing time the farmer should not undertake to practice economy by shearing with his men. It is possible for him to save himself five times the amount of his wages by observing closely the sheep after being shorn and their fleeces, for at no other time will sheep show their true form or faulty condition as when freshly shorn.

My practice at shearing time is to have a pot of black paint and a marking brush on the shearers' bench, and the first sheep shorn is marked No. 1, and the second No. 2, and so on through the flock.

I also have prepared and in a convenient place labels marked from No. 1 to the number of sheep to be shorn. A number is tied to the fleece to correspond with the number on the sheep. After the hurry of shearing is over, I get up the flock and look over the fleeces, and when I find a fleece that is not desirable, I find the sheep by its number that it came off from and place upon it a cross, which signifies that that sheep will change owners in the near future, except when such sheep may have so many good points as to overbalance the deficiency in fleece.

MARKETING.

In tying up the fleece care should be taken to keep it clean as possible, keeping all dark or colored locks inside; do not draw the strings too tight, but leave the fleece soft and fluffy. Pack the wool in a clean place and keep it covered with cotton cloth, as the light will change its color. I have seen farmers on the market in the warmest days of June, with their wool covered with woolen blankets, absorbing what little oil there was in the fleeces. When ready to sell your wool, I would advise those who produce a choice article to invite the buyer to your place, where a price can be agreed upon before moving the clip. Those who produce an inferior grade I would advise to sell on the street where, amid the hurry and bustle, they will be likely to get all it is worth, and perhaps more.

There are many ups and downs in the business of sheep breeding and the farmer who sells his flock whenever the business is depressed, or changes every few years from coarse to fine or *vice versa,* or puts coarse rams at the head of fine flocks in order to build up size of carcass, will not be likely to be satisfied with the profits of sheep husbandry.

DISCUSSION.

Mr. ——: How heavy should a fleece be for profit?

Mr. Tarbell: For fine wools it is not always the heaviest shearer that is the best, and I would not advise trying to exceed an average of over 10 pounds. My flock last year averaged 10 pounds 13 ounces, but I would not try to increase it.

Mr. ——: Would you advise tying heavy fleeces in two parts?

Mr. Tarbell: I think a choice fleece would sell on its merits no matter how large.

Mr. ——: Does Mr. Tarbell think it costs more to keep a 150 pound Downs sheep than a 75 pound fine wool? I keep both and feed no grain and can't see that it costs any more if as much, to raise a 125 to 150 pound Shropshire, than a fine wool of 75 pounds.

Mr. Tarbell: I tried coarse wools and think the Downs cost far more than Merinos. Fifty Merinos cost me no more to keep than fifty Plymouth Rock chickens.

Mr. ——: Do you not think that soil affects the question?

Mr. Tarbell: Upland is best for any stock.

Mr. ——: Would you not cross coarse wool and fine wool sheep to raise lambs for market?

Mr. Tarbell: Some farmers keep sheep to eat weeds and it makes no difference what cross they are. I would not advise pure Merinos for every one.

Mr. ——: How would you increase the size of your sheep if not by crossing?

Mr. Tarbell: I can keep pure Merinos up to an average of 100 pounds.

Mr. Sherman: I was advised to put a thoroughbred ram into my flock of common ewes. This I did twice and gained a finer and much heavier wool but nearly ran my flock out. I lost nearly one-half of my lambs. They were very small and lacking in vitality. Last summer we secured a pure Cotswold ram for 20 ewes and got 24 lambs. There is no trouble with them at all. They took care of themselves. This fall, November 1, they averaged

$3.16 apiece, some of them weighing 100 pounds. There is a great call now for mutton lambs. That ram weighs between 300 and 400 pounds.

Mr. Green: In managing my Merinos I ruled a book for records of the flock. I then took ear tags and tagged the sheep and entered the age, fleece, weight, etc., and record of lambs. I began with a flock averaging three pounds and raised it to seven and one-half pounds.

Mr. Chipman: The paper recommends washing.

Mr. Tarbell. I did not intend to take any position on that subject.

Mr. Chipman: Is there any one here who does advocate washing eight-pound fleeces? Can he get his just price by so doing?

Dr. Miles: In sheep breeding it is essential to know what you want and to stick persistently to that aim. Don't branch off to all sorts of side issues. Find out what you want and stick to your idea and work it out.

As to the question of breeds. It depends wholly on the man and the locality. Only those who produce the best will succeed. A manufacturer told me that he only succeeded in getting about one-fourth of the wool that he bought that suited his needs, and that he had to re-sell the rest.

In Virginia the Wells and Dickinson sheep were for a long while kept distinct, and that wool was sought for at 10 cents above the market price by special manufacturers.

Another manufacturer said he got his best wool from one small district in Michigan, near Pontiac. The secret is in sticking to one line.

When you try two or three objective points you will probably spoil all.

At the Hanover Institute this subject was discussed as follows:

Mr. D. R. M. Edwards: As a rule the majority are right. The fine wool sheep are, in numbers, in excess of all other breeds in the country, and I think, in the world. Other breeds have come and gone, but the fine wools stay. Fashion is powerful and this compels us to raise fine wools. As to profits: in 1850 I took fifty fine wool sheep; kept them three years; returned an equal number of sheep, and had sold $500 worth of wool in the time. Fine wools are the only ones that can be herded in large numbers on our Western plains. The fine wools are ackowledged to be ahead for wool, but for mutton it is claimed that they are surpassed by other breeds, but I have known fine wool December lambs to weigh 125 pounds, and I think the quality of mutton depends more on the cook than the breed. The darkest period for fine wool sheep has past; prospects are brightening and they will win the day.

Mr. Wetmore: Would Mr. Elwards advise all farmers to raise fine wools?

Mr. Edwards: There is nothing so good but that there may be exceptions. Small farmers near town may often find profit in raising mutton.

Mr. W. J. G. Dean: Mr. Edwards says coarse wools are not readily herded in large numbers. Our Michigan herds, where 200 is called a large one, are not what are referred to. In Australia a flock of less than 200,000 is not called large. And Australia, with the exception of Vermont and some few other points, raises the best wool of the world, and raises it so cheaply that, with their water freights, the American grower cannot compete without the tariff. I anticipate within three years a price for wool that will make fine wools profitable to all farmers.

President Willits: To what do you ascribe present low prices?

Mr. Dean: To the revised tariff of 1883, under which millions of pounds are imported. Both grower and manufacturer have suffered by this. Then, too, we did have rather an excessive number of sheep in the country. This has been immensely decreased; by 4,000,000 in Ohio alone, and prices have dropped even for the very finest bred animals, but at present, profits are bettering.

President Willits: Then you think the 4,000,000 Ohio sheep will be restored under the present tariff?

Mr. Dean: Yes, sir.

Mr. Willis, of Moscow: I am feeding grade Shropshire lambs; and I would ask Mr. Edwards if the fine wool breeders did not try to raise too heavy a wool—too much oil and foreign substance?

Mr. Edwards: Each one of us breeds for money. Fashion controls and may have led us astray.

Mr. Conklin: Why does Mr. Dean expect the price of wool to raise without an increase of tariff?

Mr. Dean: Australia has drawbacks. The drought in 1885 destroyed 15,000,000 sheep, and to-day in European markets wool is advancing every day.

President Willits: I voted for the ten per cent reduction of the tariff on wool. There was a general purpose to reduce the tariff all around ten per cent. The manufacturers claimed that they had to use American wools, tariff or no tariff, on account of its qualities, and that they also used Australian wools in connection with American wools, and so they secured a tariff which helped them more than the growers. I don't feel certain that the tariff was wholly or even mainly responsible for the reduction in the price of wool. This reduction is no greater than in wheat and iron and everything else and it seems that we are now on the up grade again. I remember a similar experience once when there was no such tariff alteration at all.

Mr. Edwards: Was there not a raise in tariff soon after the depression of which you speak?

President Willits: I think not before the subsequent rise.

SHEEP HUSBANDRY.

READ AT THE BANCROFT INSTITUTE BY MR. L. W. BARNES.

In the days when the Greek and Latin poets sang their songs, no class ranked higher than the flock-masters, and I believe a majority at least of the flock-masters of to-day stand in the front rank of our most honorable and respected "tillers of the soil." This perhaps may be somewhat due to the fact, that of all our domestic animals the sheep are the most meek and innocent in their nature.

In many cases, it has a great effect on the character of those who study the nature, habits, and requirements of the sheep, as a successful breeder or flock-master must. Especially so, with those who begin to give "Sheep Husbandry" their attention in their boyhood as did many of our most successful breeders.

Hence, I say to you, brother farmers, encourage your boys to handle and care for the sheep, and keep good sheep that will please and interest them. It may keep them from becoming interested and bewitched with fast horses, and the fast-horse business of to-day, is much too fast a business to be encouraged, as it leads to fast habits of all kinds. To be successful in caring for and handling sheep, one should be mild, careful, attentive, and thorough.

A SAFE BUSINESS.

"Sheep husbandry" is a safe business, because the capital and risk is divided into small shares. Sheep are less liable to epidemic disease and accidental injury and death than any other stock, and in case a sheep dies, its pelt, if properly handled, will usually pay for its raising, wherein it differs from other stock. It is safe and profitable because there are so many ways of realizing from it. Say, we buy a flock of breeding ewes in the fall; we have but a few months to feed and care for them before their fleeces are ready to sell for cash, and at just the time when we need the money to carry us through the summer months; then in the fall we have a fine bunch of lambs which will sell, if desired, for nearly as much as the cost of the original flock one year before. Thus, we have realized cash from our investment twice the first year, and got the stock left on hand that we started with, which is not the result if we invest in horses or cattle, or even swine.

MERINOS.

To the question, what kind of sheep to keep, I most emphatically answer the Merino, or Merino grades. If you wish to breed stock-animals to supply other breeders and wool growers, breed thoroughbreds, not only pure-bred but well-bred, and if you are starting a flock buy the best you can afford and from a successful breeder. Fix in your own mind the type or style of sheep you wish to produce. Apply yourself closely to the principles of breeding, good feeding and careful management of the flock, and you are quite sure to succeed. But it is not advisable for the average farmer to breed such or to attempt it. Their chief aim in the keeping of sheep should be the production of wool and mutton. For these purposes it has been fully demonstrated that the Grade Merino is the sheep for Michigan and for nearly every State in the Union.

The producton of wool is first in importance, as it will bear transportation. All the wool of the world has been available for any market in the world. Notwithstanding this, the price has seldom been too low for profitable production. This gives the Merino the preference at once, for without doubt they are the greatest wool-bearing sheep in the world; then they are particularly adapted to our climate, and to being kept in large flocks when desired, and to the general requirements where mixed farming is carried on, such as keeping down sprouts and briars on our newly cleared ground, and weeds and grass in our summer fallows, and thriving on the scanty, sun-parched pastures in midsummer.

In winter they can, if properly cared for, be kept in good condition on our coarse, cheap fodder with a small amount of grain, although it is better to feed a fair amount of good hay with our coarse fodder.

The reverse of this is true of the so-called "mutton" or English breeds. Our climate is not well suited to them, and they require fresh, green pasture in summer, the best of hay, with plenty of roots and grain in winter, and to be kept in small flocks in order to thrive and do well. The great value of our thoroughbred stock is best seen in the improvement made on our common or native stock. In these times of high-priced land, feed and labor, sheep should not be kept that will not shear seven or eight pounds of good washed wool per head, or ten to twelve pounds if unwashed. Such sheep can be produced from the common sheep of our country by the use of good thoroughbred sires and a careful management of the flock, which should be thoroughly culled every fall, and the old, and weakly, bad formed, or poor fleeced ones killed, sold, or put into the feeding pen for mutton. From such flocks of well graded Merinos come the best feeding wethers that can be produced, and they are eagerly sought after by eastern feeders every fall at fair prices.

WASHING.

The old and very injurious practice of washing sheep is needless and ought to be abolished, and if the wool growers of the State would unite and put their entire clips on the market unwashed, the indiscriminate rule of the buyer to discount one-third on all unwashed wool, which makes it seem a financial necessity for us to wash, would be broken, and our wool, like that of Texas, Kansas, and the West, would go to the market unwashed and be readily sold on its merits. Washing is not only cruel to the sheep but more or less injurious to the fleece, especially to our best wools, for wool in which there is a proper amount of oil cannot be well washed in common cold water. The color and dirt from the outer ends of the fleece is carried through the fleece and the entire length of the fibre becomes stained or crocked, thus giving it a dull, dingy, dead appearance instead of that bright, lively luster that we see in our well handled, unwashed fleeces. A sheep will produce more and better wool in the course of a year if shorn before the middle of May, unwashed, than if forced to carry that heavy fleece and the filth they naturally gather through many hot days till washing time, then be driven several miles to the creek, and with heated blood plunged into the water and soaked, and then left to carry its cold, wet mass of wool until dry, and finally shorn and turned into the pasture to again suffer, this time from the want of a little covering to protect from the extreme heat of the sun and the swarms of mosquitoes and flies that attack them, while the early shorn sheep is by this time provided with this protection and rests contented.

FEEDING.

Sheep in the fall should be sheltered from heavy rain storms, and not later than November 1st the breeding ewes and lambs should be brought to the barn or shed at night and fed what hay they will eat up clean, supposing that the lambs have before this been given a small feed of oats, or oats and bran once a day. If the pasture is very short (which is apt to be the case at this time of year) we would also give a feed of oats once a day to the breeding ewes. And it is much better to give grain at night as the sheep come from the pasture as they relish it better then, and I hold that it does them much more good than if eaten when their stomachs are empty. No portion of the flock, however, should be allowed to run down before going into winter quarters, for it is much easier to keep sheep up in good condition than to get them up after they have run down.

All ewes should be thoroughly tagged (and other sheep if they need it) and their hoofs properly trimmed before winter sets in. During winter, as in the fall, keep the lambs and weaker ones by themselves as they require better care and feed to develop them and keep them in good condition than mature sheep. Good clover hay (fed in the shed morning and night) with cornstalks or straw and a good feed of grain in the yard during the day makes a very good winter feed for lambs, although some would say they should have roots in addition to the above. As for breeding ewes I should feed wild or bottom land hay or cornstalks in morning in yard (if not too cold or stormy), grain and straw at noon, and good clover hay in shed at night, and be sure that they exercise freely in the open air each day, as that is essential to the health of man or beast, and especially so to breeding animals. For grain during winter I prefer one part corn, one of bran and two of oats, and all sheep should have free access to salt and water both winter and summer if possible.

The breeding ewes should again be tagged before they begin to yean their lambs, and about this time I should prefer to begin feeding clover hay both morning and night, as more feed is now required to keep them in condition.

I would prefer to have all the lambs yeaned by the 1st of May. We always raise a greater percentage of April lambs than of later ones, and they get a better growth during summer, go into the winter in better condition and make better sheep than later ones.

I would begin turning my sheep out in the spring as soon as the grass got well started, and give them a light feed of both hay and grain when they come to the barn at night until there was sufficient substance and nutriment to the grass, for when grass first starts in the spring it is not very nutritious. I would have the shearing done from first to middle of May. Keep sheep housed at night and during storms until into June, and thus have a healthy, thriving flock, free from the damage done by the perplexing and dangerous maggot fly so common at this season. During summer look to your sheep often, do not keep them too long in one pasture, give them a change, and a rather short pasture is best, but not quite as short as some I have seen.

BREEDS OF SWINE.

BY D. P. JACOBS OF CONCORD.

[Read at the Hanover Institute, February 8, 1887.]

Mr. President, Ladies and Gentlemen—Through the courtesy of your committee of arrangements I have been honored by an invitation to read an essay upon the different breeds of swine.

Location, climate, habits, care and feed all have their effects upon our domestic animals. Different breeds of animals belonging to the same general class are formed in different countries, and individuals of these several breeds are so unlike that it is hard to believe that they all sprang from one common source. The massive Percheron horse could no more have been produced on the plains of Arabia than tropical fruits could be grown in Alaska. The noble Short Horn could not have been produced on Jersey Island nor the Shropshire sheep in Spain. Each country, owing to peculiarities of climate and conditions produces distinct characteristic results. And thus it is with our swine. They have, in different countries and in the hands of different breeders who held different opinions of what the hog should be, become changed and known as different breeds which are very dissimilar. It is not my purpose to enter into a detailed description of the twenty or more so-called breeds, but I have selected a few of the leading breeds to consider.

BERKSHIRES.

In tradition and history the Berkshire figures among the largest and heaviest breeds of England. The old time Berkshire weighed at maturity from 700 to 1,000 pounds, and in some instances even more. Originally they were mostly of a buff, sandy or red color, spotted with black; sometimes white and spotted in the same manner. They were coarse in bone, head large and heavy, ear thick and lopping; broad on the back, deep in the chest, flat sided and long in body, with very fair hams and shoulders. The body was covered with a thick, heavy coat of long curly hair, and was mounted on quite short, strong legs; flesh nicely marbled; and on this account highly prized in England. They were slow feeders and did not mature till two or three years of age. However, much improvement had been made before they were introduced into the United States.

Mr. A. B. Allen, who ranks high as authority on the early history of this breed, states that the first importation of Berkshires was made by John Brentnall of New Jersey, in the year 1823. In 1841 a sort of a Berkshire craze swept over this country, caused by the exertions of parties then interested in the breed, and stock changed hands at very high prices. They are said to have been hogs that possessed a great deal of merit, but through the neglectful manner of stock raising at that time, they fast degenerated, and the Berkshire became an object of ridicule and disgust. But this reaction was not permanent, and to-day there are many champions of the breed both in the United States and Canada.

The standard points in this breed are: Snout, fine and inclined to be short; head, fine but larger in proportion to the body in the male than in the female, broad between the eyes and face well dished; jowls, full or otherwise as the breeder may fancy; eyes, bright and expressive; ears, small, thin and upright: neck, short, rather full in throat and harmoniously swelling to the shoulders; chest, broad and deep; back, broad and moderately arched, rump nearly level with it; shoulders in the male extra thick, yet sloping smoothly to the body; hams, broad, round and deep; legs, fine, strong, of moderate length and set rather wide apart; feet, small, with clear, tough hoofs; bone, fine and of ivory-like grain and hardness; hair, fine, soft and silky; movements quick and spirited; carriage stylish, and the male bold and imposing in appearance.

CHESTER WHITES.

This is one of our largest breeds of swine, and like most others was produced by crossing different breeds and giving a name to the produce after they had been bred in a certain way long enough to possess some fixed types. In the year 1818 Mr. James Jeffries, of Chester county, Pennsylvania, imported from Bedfordshire, England, a pair of hogs known as Bedfords.

These hogs were crossed and re-crossed upon the common stock of that locality until they began to attract considerable attention. In the mean time, as is usually the case in such matters, farmers had selected their best young stock and retained them as breeders. Within a few years Chester county became noted for a class of hogs of enormous size and white color. Hence the name Chester White. They were docile in disposition and good feeders. Within the last score of years a radical change has taken place with the Chesters, and so thorough has been that change that the breed retains to-day very few of their former characteristics except the color. I am inclined to give Mr. S. H. Todd, of Wakeman, Ohio, the lion's share of credit for the improvement that has been made in this breed, and think that he has drawn largely from the Suffolk, Yorkshire, or some of our other small white breeds in making crosses to refine this breed. Let us compare the Chester White of twenty years ago with one of Todd's Improved Chesters and note the difference. We only have from one-half to two-thirds the quantity in the latter that we had in the former. Quantity has given place to quality. The broad, thick, slouching ear has disappeared and one of more moderate proportions taken its place; that coarse, heavy head has been modified to a great extent; the long, lank body has been shortened and thickened; that thick, wrinkly hide that more resembled some of the skins of the Merino ram than anything else, is gone; the large, coarse, spongy bone has been reduced in size and one of finer quality and every way stronger has taken its place. The Chester White has come to stay, and I would predict that for many years to come he will be the favorite with that class of men who prefer a large, smooth, growthy, white hog.

One breeder claims by special breeding to have rendered his Chesters cholera proof, and he calls his animals the Ohio Improved Chester Whites, but I should look on the claim with great suspicion.

The swine breeders' convention agreed upon the following description of the characteristics of the Chester Whites: Head short and broad between the eyes; ears thin, projecting forward, and lopping at the points; neck short and thick; jowl large; body lengthy, deep and broad on the back; hams full and deep; legs short and well set under for bearing the weight; coat thinnish and white, straight, and if inclined to be wavy not objectionable.

YORKSHIRES.

The Yorkshire had its origin in Yorkshire, England, and is said to have been produced by crossing the white Chinese upon the common stock of Yorkshire. There are, however, several so-called breeds of swine that according to the best authority are nothing more or less than the different strains of this same Yorkshire blood, viz.: The large and small Yorkshire, the Cheshire, Suffolk, Lancashire, York-cumberland, and most other small breeds that have their origin in England. I regard the small Yorkshire as one of the very best of our small breeds. They are invariably found covered with a good coat of white hair of medium length, though upon their skins may often be found small bluish colored spots. They weigh at maturity from 300 to 400 pounds alive and are usually very hardy for hogs of their kind. The sows are quite prolific and make good mothers. They are good feeders and can be fattened at any age. The ear is small, quite thin, pointed and very upright, nose short and inclined to be broad, wide between the eyes and short well dished face. The National Livestock Journal said of them a few years ago that they were the shortest nosed, most dished faced and most easily fattened pig in existence. They are always found with short, thick neck, heavy jowl, good shoulder and back, and fair loin, and while they may sometimes be found lacking in the ham and inclined to be short in the body they are very deep, and when well fattened are so broad on the back that they approach nearer a cubical form than any hog that I am familiar with. This cubical shaped body is most always to be found mounted on short, fine boned legs that seem capable of carrying all the weight that their possessor would be liable to have.

POLAND CHINA.

I believe there are more Poland Chinas and their grades in the United States to-day than there are of all other breeds and their grades combined. The breed originated in the southwest corner of Ohio, in Warren, Hamilton and Butler counties. As early as 1816 we have indisputable proof that there were two distinct breeds of swine in the Miami Valley, which had been brought with them by emigrants from the old country, called the Russia and the Byfield. They were crossed and recrossed with the common stock of the locality, and it is said that great improvements were made by the use of the two breeds. The next direct cross was made by the use of the Berkshire, about 1835. The last cross was made by the use of the Irish Grazier. Mr. Wm. Neff, of Cincinnati, made a direct importation of the last named breed in the fall of the year 1839. It was this breed that gave the finishing touches to the now called Poland China. Thus they have remained for more than thirty years.

ESSENTIALS OF A GOOD HOG.

It will now be in order to discuss the merits of these breeds by comparison. But first we must take into consideration that the hog is situated differently from most animals raised by farmers. Each breed of cattle, horses and sheep seems to have been bred for some particular place, which they alone are best adapted to fill. Not so, however with the pig. His object in life is always the same, to eat and grow fat, and his destiny is the pork barrel. This being true, we have only to secure that breed that can be got into condition for the barrel to the best advantage. In other words the hog is a corn market and we want to patronize that market that will pay us the highest price for our corn. The ham is the most valuable part of the hog, and next in value is the shoulder, consequently we must have hogs with good, thick, heavy hams and shoulders. Next comes the side pork. We must grow the hog whose sides will hold their thickness well down and not be thin and flabby at the lower end of the cuts, in short one the greatest percentage of whose live weight is good, saleable meat.

In selecting a breed of swine the most important things to be taken into consideration are early maturity, size, quality, form and disposition. The latter may seem of little moment, but in reality it is just as essential to have hogs of good, quiet disposition as horses or cows. Cross, fretful, restive hogs are seldom good feeders, the females are not good mothers and the males are dangerous to handle. We want a hog that has good digestive machinery, that will eat what you give him and go to his bed and lie down, not one that takes a bite or two and then commences travelling around his pen squealing for something he has not. This performance may have a tendency to develop muscle but does not assist in laying on flesh. There is one thing that should not be overlooked. I refer to the girth around the body, just back of the shoulders, or what is called heart girth. This should never be less than the flank girth; if it exceeds the flank girth all the better, for it denotes strong constitution and plenty of lung room. In quality our hogs should have a soft, mellow feeling when the hand is placed on them. Hogs differ as much in this respect as cattle or other animals.

Early maturity is very essential for the reason that it shortens the length of time that we have to feed.

Next, we must be careful to select hogs with good, strong bone, not too coarse nor yet too fine, for both of these have been found incapable of supporting heavy weights. The bone should correspond with the size of the hog, and should taper from hock and knee joints to the feet. Usually such a bone is strong. Now, let us compare the four breeds that we have had under consideration, and draw conclusions from the same.

Berkshires.—It has long been acknowledged that the Berkshire produces pork of superior quality, it being well marbled, and on this account he is the best of bacon hogs, He has great length of body, and therefore produces an abundance of side pork. He has a heavy shoulder, but the ham is often found to be light, it being not uncommon to see specimens of this breed that appear to be wedge shaped, with the large end forward. Then again, the Berkshire is of a restive disposition, and inclined to be wild, unless he has the most gentle treatment. To this roving disposition the nicely marbled condition of his flesh is due. So much exercise develops the muscle or lean meat upon the carcass. The pigs are very growthy, but do not fatten well till ten or twelve months old. When nearly matured they are good feeders and heavy weighers. They are usually healthy, strong fellows, and are gaining favor quite rapidly.

Chester Whites.—These have many friends among men who are particular about color, and are opposed to the black hog, yet want a large, straight animal of good form and feeding qualities. The Chester White seems to meet their views. There are several objections to the Chesters, and among them there are two that are quite prominent. First, there seems to be quite a deficiency in the strength of the bone of the hind leg, especially while young. Second, they are slow to fatten while young. They grow well but are hard to get in good pork condition till a year or more old, but after that there are few breeds if any that surpass them as feeders. We see this demonstrated in the show ring. We see the aged hogs in the best of condition, while the pigs from four to six months old most always present a lean, lank appearance. Chester White breeders will tell you that they are opposed to putting their young stock in high condition. As a general rule it is impossible for them to get their pigs in good show condition. What we want is a hog that we can make fat at any age, from four months to a year and one half old.

Yorkshires.—The Yorkshire possesses these qualities surely, but he has his faults also. No hog is perfect. The trouble with the Yorkshire is his lack of size. The Yorkshire pig is inclined to stop growing just as soon as he commences to become fat, and buyers meet you with the objection that they are too light for anything but brock hogs. They also claim that when they are placed in the car with the larger hogs they do not stand the journey well, being often crowded to death on the way. But for the farmer that only keeps a few hogs for his own use and wants a nice, blocky animal that will be ready for slaughter most any time, I don't know of a better breed than the Yorkshire.

Poland Chinas.—For a market hog I know of no better breed than the Poland China, for several reasons. First, he is a good seller in any market; I know of no hog that outsells him; he always brings the top of the market. No one pretends to find fault with form or feeding qualities of the Poland China, except some of the breeders of small breeds. They sometimes set up the claim that he is too large and too heavy a feeder. To the former charge I would say, fatten them while young. And right here is where the Poland has a great advantage; he can be fattened at any age and does not stop growing when he commences to become fat, but will grow and fatten at the same time. To the latter charge I would say, what of it? What if he is a heavy eater? Does he not pay as well or better than other breeds for what he eats? Does he not make as great a gain in flesh for the amount of feed consumed as any other hog? If he does, why find fault about what he eats? It would be just as reasonable to find fault and refuse to sell your wheat to an extensive wheat buyer or large flouring establishment because they took such large quantities, though you are forced to acknowledge that the same parties paid you the very highest market price for every bushel of grain that they bought from you. I have been informed repeatedly by different shippers that the Poland would bring in the Eastern markets from ten to twenty-five cents more per hundred pounds than any other hog of the same weight and condition. He combines early maturity, strong constitution, good size, and the very best of feeding qualities. Do you ask for more than this from a pig? If so, I do not know where to find it.

SWINE AT FAIRS.

It would seem, judging from general appearances, that pork raising was one of the minor industries of our nation. Take for instance the position that our Agricultural societies (the great educators) have assumed in this matter and ascertain if they don't speak by their actions as plainly as they could by words that the hog is of little or no account. We enter their fair grounds and the first prominent object that the eye falls upon is a nice smoothly graded and evenly curved race course. We glance around that track and probably see a half dozen horses being exercised thereon preparatory to one of Josh Billings "Agricultural hoss trotts." At the tap of the bell the horses are brought to the line, positions assigned, and after several ineffectual attempts at a start they get the word and away they go. This performance is repeated several times with varying results and a great event has been decided, of which in many instances the outcome is that some old ringer has been smuggled in and carried off the agricultural purse.

We turn from the track to look for other features of the fair and find a long row of horse stalls fitted out comfortably. The next best space is reserved for cattle, and they also have been well looked after. The sheep pens come next and are found in good shape, covered with good tight roofs and presenting a tidy appearance. But, says one "What is that down yonder in those old shabby pens with the fallen down roof that looks more like a few boards leaning on a fence than anything else?" We take ourselves thither and discover that this is the swine department of this great agricultural fair, the very location of which and the manner in which it is fitted up plainly say that the society has passed judgment on this department of their show and decided that it was of little moment. Well, brother farmers, they are not wholly to blame for this. They have only echoed the very ideas that some farmers seem to possess, judging from the manner in which they treat their own swine. How often do we find huddled together a half dozen or more poor, gaunt, shivering pigs, their bed the cold, wet ground, their shelter the rail fence. How about their feeding ground? "Oh, that is all right," says the farmer, if the mud and filth is not more than six inches deep. The farmer gets a half dozen ears of mouldy corn and into this filth they are thrown for the poor, starved pigs to fish out as best they can. This constitutes their days rations. Then Mr. Farmer turns to us and says that he does not go very much on hogs any way, and that he never could make them pay. This same man will talk to you by the hour about that fine Hambletonian colt of his, telling you of his wonderful speed, his long pedigree and the wonderful performances of some of his remote ancestors. This man will be fortunate if he does not squander half his farm on this colt in trying to make a trotter of him, and in the end have on his hands a broken down horse, worth perhaps seventy-five or one hundred dollars. This is the kind of educators that our Agricultural societies are fast becoming.

Well, let us see about this poor, despised industry. Take the statistics of the Chicago stock yards, and what do we find? During the year 1886 there were 6,718,761 hogs received there, and this was a decrease from the year before to the amount of 218,774 hogs. On December 5, 1884, Chicago received 66,597 hogs. For the week ending November 20, 1880, 300,488, for the month of November of the same year 1,111,997, and for the whole of 1880 7,059,305 were received. Within the last twenty years Chicago has received 90,983,543 hogs, representing in value more than one billion of dollars. While I would not advise any farmer to make a speciality of raising swine,.each one should raise a limited number, and give them just as good care and attention as you do the rest of your animals, and you will probably find in the end that they have paid you as well in a series of years as any of your stock.

ROTATION OF CROPS.

BY ALDEN B. SWIFT.

[Read at the Charlotte Institute January 17, 1887.]

With all the practice of the centuries, it was not until science began to be applied to agriculture that we find the greatest progress made in this noble calling. Among the many ways in which agriculture has been benefited by the application of science, none have been more important than the methods of increasing and maintaining the fertility of the soil, and notable among these is the system of rotation of crops. It was not left for the present age to discover that a continual cropping of the land by the same crop year after year, exhausts the soil to such an extent as to make the further cultivation of that particular crop unprofitable. The ancient Romans provided against this by alternating a wheat crop with a whole year of fallowing; that is, their rotation consisted of first year wheat, second year fallow, thus securing but one crop in two years.

Many portions of the earth which under the ancients were very productive, have become exhausted to such an extent as to be almost worthless.

The large number of inhabitants that Palestine supported under the Jews, is the wonder and admiration of all modern travelers, who are struck with the ruin and desolation that marks the country to-day.

Time was when to sow a crop of wheat in California was a sure foundation of future profit, but steady cropping, without just compensation for the elements removed from the soil, steadily reduced the yield, until other means had to be resorted to, to maintain its record as a wheat producing state. But we need not go to California, nor to ancient Rome, nor to Palestine, to find evidence to maintain our position, for we can find it at the present time, in our own State. By a careful study of the reports of the Secretary of State, you will find that the counties in which are cultivated the greatest variety of crops, almost invariably produce the greatest average yield per acre, of each crop cultivated.

It is unnecessary to multiply evidence to show that some method of rotation of crops is essential to the best results, for it is apparent that when the soil is exhausted, in a measure, of the elements necessary to grow one particular crop, it may be rich in the elements which enter into some other crop of a different nature, and the growing and cultivating of the one may be arranged many times with reference to fitting the ground for the others.

What is the system best adapted to our wants ? This a question that each must decide largely for himself, as there are so many things to be taken into account, such as soil, climate, markets, the amount of available manure, the amount of live stock kept, the likes and dislikes of the husbandman, etc.

There are two general systems of rotation, the fixed, and the variable, both of which have many advocates. By the fixed, is meant that system in which the crops succeed each other in regular order, and by the variable, that in which there is no regular order of succession. Most writers when speaking of a rotation of crops refer to the former, and would hardly admit that the latter method had merit enough to entitle it to be classed as a system. In favor of the first system, it is argued that it not only maintains the fertility of the soil, but divides the farmer's work in such a way as to enable him to accomplish the most in the course of the season, gives him a liberal supply of all kinds of crops, and even in a season unfavorable to one crop, that others of an opposite nature will, by an extra yield, maintain the average for the year. Those favoring the variable system, claim that it enables the farmer to treat the different fields of his farm to that kind of cultivation to which each is adapted, thus avoiding the necessity of planting a field with a crop which is not suited to that particular kind of soil. It enables him to take advantage of the different seasons and circumstances and the variation in price, thus securing an abundance of those crops that pay the largest profits, and at the same time by a judicious management in the arrangement of the succession of dissimilar plants the fertility of the soil may be sustained. They affirm that in the former system the map or chart of his rotation is the only thing to be consulted in deciding what to plant, while in the latter, he is enabled to bring into use all the science and skill of which he is master.

Before deciding upon any particular course of rotation the husbandman should first study the nature of his soil and the nature and habits of the different crops he desires to enter into the rotation, and strive, as far as possible, to have the most dissimilar plants succeed each other. If wheat is to take a prominent place in the rotation, then make red clover another prominent factor, and should wheat be left out retain the clover, and the more clover the better, especially if it is not allowed to remain seeded too long. Two years should be the outside limit, and if it is plowed up after one year, and more seeded so much the better. But if clover is raised it will be necessary to keep stock to consume it, and if stock is made one of the prominent features, then a root crop may be introduced with profit, and if from any cause it is not thought expedient to put any other crop on a field, sow something for a crop of green manure, and thus avoid letting it lie idle. If there is any one crop whose virtues I would extol more than another it is red clover, and whatever system of rotation is adopted, whether long or short, fixed or variable, it should be recognized as the most important factor in restoring and maintaining the resources of the soil.

Mr. Claflin: What crops would you select for rotation?

Mr. Swift: That would depend wholly on soil, climate and circumstances· Corn, roots, oats, wheat, clover, clover is the rotation at the Agricultural College.

Dr. Miles: I want to emphasize one or two points. By rotating you can get a greater aggregate yield. At Rothamstead they grew wheat sixteen years in succession, and on a similar field they grew wheat every other year and fallow alternate years for sixteen years, and this gave as much wheat as the every year wheat. Then they tried alternating wheat and beans and got the same amount of wheat and had the beans in addition. So you see the land would only give a certain amount of wheat in so many years. You can take that and get other crops in addition by rotating. Another gain in rotating crops is the distribution of labor more evenly through the different seasons of the year. Again, if every one in the country should try to depend on commercial fertilizers the supply could not possibly meet the demand. The barnyard must be the dependence, so your rotation must contemplate stock keeping and this must include a varied diet.

Mr. Bradley: Which of the three soils, sixteen wheats or eight wheats and eight fallows, or eight wheats and eight beans were left in the best shape?

Dr. Miles: I can't give the exact figures but the continuous wheat left the soil better than the wheat and fallow, as the fallow admits a waste of material. The alternate wheat and beans left the soil in the best condition.

Question: How about alsike?

Dr. Miles: Very fickle. I never could grow as much alsike as I could red clover.

Mr. ——: Is drilling or broadcasting best?

Dr. Miles: It depends on the conditions. Drilling is more convenient and better where there is danger of frost.

Mr. Swift: Does not green manuring mechanically improve the soil?

Dr. Miles: Leguminous crops like clover, etc., bring up nitrogenous elements from the subsoil. Green manuring does have a good effect in making heavy soils more porous and light soils heavier.

Mr. ——: How can we produce a sufficiency of barn-yard manure?

Dr. Miles: What we already have would go farther if it were better cared for and utilized. Its value is not appreciated. Farmers do not understand that as compared with the market prices of commercial fertilizers the manure from feeding a ton of corn is worth $6.00, from a ton of cornstalks $4.00, from feeding the product of an acre of corn $18.00, from forty-five bushels of oats $8.00, from a ton of timothy hay $4.50, and from a ton of clover hay $8.00. If this were appreciated there would be less waste. If your barn-yard manure is insufficient you can afford to buy more stock and more stock feed.

Mr. Sherman: I like to hear these fancy theories but I can't realize them on my farm. The values given for the manure from feeding crops is greater than the total that I am able to realize from my crops. I sacredly restore to my land all the manure that my farm produces; but I find this insufficient and have to supplement by plowing under clover.

Dr. Miles: I would remind Mr. Sherman that I only gave the valuations that I did, on the basis of present market prices for commercial fertilizers. If they are worth the prices paid for them, then the different crops named are worth the sums given, for the manure that they will make, besides their feeding value. Dr. Voelcker, found farmers who claimed that the greatest value could be gained from the clover crop by raising clover seed. He got them to experiment carefully as to plowing under, feeding it off, and letting it go to seed, and proved to them that the advantage was just in the order named, plowing under being most profitable and raising seed least so.

Chairman Green then read the following article on Rotation of Crops by Prof. J. W. Sanborn, describing the system which he was practicing on the college farm, and which he recommended to Missouri farmers as worthy of practice:

"This system is one of rotation of crops and the feeding of the same on the land. The rotation suited to a large part of this section is a two year one. Taking, say 120 acres of plow land, we would divide it and crop as follows: Starting with timothy sod, 20 acres should be manured and plowed for corn in the spring following. This is cut up in the fall, shocked and husked as soon as dry, the corn cribbed in narrow bins and the fodder put into stacks; the land plowed for oats in the spring, and seeded down to clover. The oats are cut early while green for hay, thus giving the clover a chance to come on and make a second crop. The next or third season two crops of clover are cut, the second one for seed, and the land manured and plowed in the fall, sowed to wheat, and seeded to timothy, which is allowed to remain two years, being manured and plowed for corn after the second crop is taken off. Thus we have completed the round of six years, and have in the time grown seven crops (two crops of clover in one year) and have manured the land twice. When the system is extended to the whole 120 acres the crops for each year will be, 20 acres of corn, 20 of oats. 20 of clover, 20 of wheat and 40 of Timothy. This round is to be continued, plowing up the 20 acres of Timothy each year which has borne two crops. Thus the land is not exhausted by continued cropping of one crop, and the entire farm is manured once in three years, or if one crop is manured a year, once in six years.

"Of the crops grown only the wheat is sold, the rest being all fed upon the farm, and the manure carefully saved and returned to the land. This process would result in a few years in such an improvement in fertility, that 30 bushels of wheat would be averaged per acre, 80 bushels of corn, four tons of hay and so on. Add to the large increase in the feeding crops, shelter for the stock and an economic and scientific method of feeding, the farm would be enabled to keep 300 head when now it only half keeps 100 or less.

"The benefits to be derived from a system like this are numerous. First, it divides the work throughout the year. With only 20 acres of oats to put in in the spring on land plowed in the fall, it is a short job, and out of the way in time to get the corn planted in prime shape. So it is with all of the crops; each is out of the way of the other, and no hurry to get through. Then with the large amount of feed to handle and stock to care for in the winter the help needed in the summer is needed in the winter, and thus the men are retained in service from year to year."

ROTATION OF CROPS.

BY PROF. J. W. SANBORN, OF THE MISSOURI UNIVERSITY.

[From the Proceedings of the Society for the Promotion of Agricultural Science.]

This paper will give the results of a practical test of the influence of rotation of crops. It will not be without its interest to men of science, as a confirmation of profound scientific reasons favoring crop rotation in commercial farming.

That it does not cover soil analyses at the start of the trial, and at the end of the first rotation period, nor analyses of the products, and further critical inquiry, is wholly due to the fact that the trials were made from the revenue of a poorly equipped farm, without any outside resources whatever. The actual crop results of a rotation were believed to amply justify such a trial; for if it could be shown that applied science is practicable and economical in its relations to our system of crop growth, scientific agriculture would be aided thereby.

The rotation carried forward and to be reported was not either a good scientific or a good practical rotation, yet of some merit in each direction. Its character was determined by the purpose and apparent necessity to start with wheat for all of the five plats, and to limit it to a four years' course.

In any good rotation in Missouri, into which wheat enters, clover should precede wheat. The test of the efficacy of the rotation to be related was to be found in the fifth crop, when all plats again start the second rotation round with wheat; this fifth year crop of wheat to be the measure of the efficacy of rotation.

The principles of rotation, which rest upon the diverse root areas occupied by the various plants; upon the character for soil solution of the acids secreted by their roots; upon their leaf characters; upon the various proportions of plant-food elements used in growth; upon the various parts of the season in which they mature; upon the relation of rotation to insect and fungus enemies, and to several other essential points or laws involved are such that almost any rotation may be safely counted upon to give larger yields than will be received where a crop follows itself in succession, as in the West, for years.

Theoretically, deep and shallow rooted plants, narrow and broad-leaved plants, plants maturing early and late, and plants of diverse feeding characteristics should alternate.

If our trial, which only in part meets these considerations, is emphatic in its support of rotations, then we can fortify science by art in our efforts to induce our farmers to adopt rotation of crops.

THE ROTATION.

Plat 9. Wheat to follow wheat, unmanured.

Plat 10. Wheat to follow wheat, manured, 1,200 pounds annually.

Plat 11. Four years' rotation, manured, 1,200 pounds annually, and crops as follows: Wheat, clover, corn, potatoes, wheat.

Plat 12. Wheat, corn, wheat, or two years' rotation, manured with 1,200 pounds yard manure annually.

Plat 13. Same as Plat 11, or four years' rotation, unmanured.

Area, 1-10 acre; soil, clay loam, with compact subsoil at fifteen to eighteen inches deep.

By some error or oversight the plats were not all recorded for 1884. The winter of 1884 and '85 was severe on the plats, which were somewhat exposed, resulting in badly winter-killing the wheat. Grass came in abundantly, and was allowed to grow, and its weight, with the wheat and straw together, were taken. The ground was apparently of even quality, but its history is unknown to me, therefore I cannot explain the uneven crops of the first year. This was gradually eliminated, and the fifth crop, and the average of all of the crops were consistent with each other.

TABLE OF YIELDS PER ACRE.

Plats.	1883.		1884.		1885.		1886.		1887.		Total yield in lbs.
	Wheat, bu.	Straw, lbs.	Wheat, bu.	Straw, lbs.	Wheat, bu.	Straw, lbs.	Wheat, bu.	Straw, lbs.	Wheat, bu.	Straw, lbs.	
9	18.91	3745	------	------	----------	3560	13.93	1310	13.91	1355	12,775
10	20.16	3330	------	------	----------	3760	23.66	2180	24.28	1995	15,351
					Corn, lbs.	Fodder, lbs.		Potatoes, lbs.			
11	15.66	2790	------	------	4270	5910	------------	6460	38.08	3867	26,561
						Wheat and hay lbs.	Corn, bu.	Fodder, lbs.			
12	9.66	1700	------	------	----------	5220	21.10	2900	32.76	2372	16,347
					Corn.	Fodder.		Potatoes, lbs.			
13	4.66	1380	------	------	3200	3750	------------	3200	30.16	2465	18,102

The total yield of each of the plats, and especially the yield for the fifth year, are of very great interest. No other interpretation can be put upon it than one most favorable to the view, that most valuable laws are involved in aiding a maximum yield when rotation is pursued, and it teaches beyond question the great commercial value of rotation.

The yield of grain per acre on the rotation plat is fifty-seven per cent. more than the non-rotation plat. This applied to the United States would make from 225,000,000 to 300,000,000 more bushels of wheat, according to season, than now raised. This system of farming, instead of involving more expense, is actually more economical than the non-rotation system, in all of its parts.

The table shows that even a two years' rotation has its decided virtues. Again, the unmanured rotation plats are more productive than the plats where wheat follows wheat year after year, yet the continuously manured wheat plats are nearly twice as productive as those non-manured. Thus it would seem that manuring is very efficacious, but that rotation is more efficacious than manuring.

The truths herein taught are fully confirmed by our regular farming. On coming in charge of the farm, I adopted a six years' rotation, which is proving more effective than the rotation plats, as it was laid out as it then could be, more in accord with science. The crops have very rapidly enlarged, and this year, wheat following clover, the field crop averaged 45½ bushels per acre, and the hay three tons.

I regret, gentlemen, that circumstances forbade me from organizing a more perfect rotation, and enforced a limited study of the question. What I have offered is only an opening chapter, as fortune now favors, through appropriations, a more complete study of this and other questions, than I have heretofore given them.

CORN CULTURE.

BY MR. E. J. COOK, OF OWOSSO.

[Read at the Bancroft Institute.]

Mr. President, Ladies and Gentlemen:

Remembering that time is money, we should so manage our work as to accomplish the greatest amount in the shortest time. Horse muscle is cheaper, more willing, and far more effectual than human muscle and, therefore, should be used whenever practical.

The requisites to successful corn culture are good rich soil, good seed and timely, thorough and proper cultivation.

I use my barn-yard manure mostly on my corn ground, make it under cover, draw as it accumulates and spread on field for corn. That drawn in early winter is much better than that drawn after spring opens, and there is but very little if any benefit to the corn crop derived from that spread just before plowing, therefore I reserve that made after spring opens for other crops. I use sod ground for corn and fit and plant as soon after plowing as I can.

Seed corn should be selected either before or at the time of husking, thoroughly dried and kept in a dry place until wanted.

I plant with the common grain drill, using two hoes, and planting the rows about four feet apart. Make the rows run north and south if the field is square, if not, then the longest way of the field, leaving six or eight feet at the ends not planted to turn around on after cultivation. Immediately after planting I roll the ground to press the soil to the seed. Just before the corn comes up I drag it thoroughly lengthwise of the rows with the Thomas or slanting-toothed harrow, and cross it with the same about a week after. If the weather is not favorable to the growth of corn or if worms are disturbing it, I can drag it again to good advantage. Then I cultivate about once a week until it gets too large to pass over it with the two-horse cultivator or spring-tooth harrow, taking out middle teeth and letting the horses walk astride of the row. This frequent cultivation is very important as it keeps the ground more moist, and the weeds are much more easily killed just before or as soon as they make the least appearance than they are if allowed to get a vigorous start before they are molested. And I find the crop is wonderfully benefited by working the soil as soon after showers as it becomes dry enough, but serious damage is done both to the crop and the soil if worked too wet.

I have found that the large Dent corn does not do as well planted in this way as the smaller kinds, and if so planted, must be much thinner. I use about twice as much seed as I did when planting in the ordinary way.

About the middle of August I sow rye in the corn for fall, winter and early spring feed, and I think it a good thing.

My corn harrow is about ten feet wide and one can drag twenty acres in a day without trouble, and a man will cultivate with the cultivator or spring-toothed harrow eight or ten acres a day throughly.

If now I can cut my corn up in the fall with the binder, as some farmers claim to have successfully done, and thresh it with the threshing machine, delivering the clean shelled corn in the half bushel, and the stalks in the mow, all crushed and torn in shreds, ready to be mixed with the meal, I shall feel that the production of this, the most important product of our industries, is no serious matter.

SORGHUM AS A SUGAR PRODUCING PLANT.

(ABSTRACT.)

BY PROF. H. W. WILEY, CHEMIST OF U. S. DEPARTMENT OF AGRICULTURE.

[From the Proceedings of the Society for the Promotion of Agricultural Science.]

The problem of the possible profitable production of sugar from sorghum has occupied the attention of chemists, agronomists and manufacturers for thirty years. I have thought I could not make a more useful contribution to the proceedings of the Society for the Promotion of Agricultural Science than by presenting a resume of the progress which has been made in this important study.

I will not insist here on the immense advantages which would accrue to American agriculture by the development of an indigenous sugar industry. There is no true friend of our farming interests who does not wish our sugar to be produced at home, and if sorghum can help to the consummation of such a wish, we ought to know it. Unfortunately human desires, even when benevolent, are not always attainable, and in spite of the most earnest endeavors, both on the part of private citizens and the Department of Agriculture, we are still compelled to submit to seeing our sugar obtained by importation. I gave a full discussion of these aspects of the sorghum question in my presidential address before the Washington Chemical Society, which has been published in its proceedings, Bulletin No. 2.

In order to learn as nearly as possible, the exact composition of the sorghum juices which have been produced in this country, during the last thirty years, I have examined all the chemical data accessible. These data I have divided into two parts.

In the first I have collected together the means of all the analyses made by the Department of Agriculture, and in the second part, the same thus derived from other sources. The number of analyses represented in these data is enormous, amounting to many thousands.

Having collected the means of all the analyses made by the Department of Agriculture, I found the following to be the average composition of the juice. These analyses extend from 1862 up to the present year, but most of them have been made since 1878:

AVERAGE OF THE MEANS OF THE JUICES OF SORGHUM CANE MADE BY THE DEPARTMENT OF AGRICULTURE.

Sucrose	11.34	per cent.
Glucose	2.80	"
Total solids	17.37	"

In like manner the average of the means of the analyses of sorghum juices, made without the Department, is as follows:

Sucrose	10.00	per cent.
Glucose	3.83	"
Total solids	15.99	"

The above two sets of averages have been based solely upon experimental work; that is, they were made on small samples of sorghum, and, therefore, do not represent large crops.

Following are the names of the analysts upon whose authority the above rest: Wetherill, Erni, Antisell, Collier, Wiley, Browns, Jackson, Smith, Goessmann, Lovering, Leplay, Hilgard, Weber & Scovell, Weber, Henry & Swenson, Pirotta, Monselise, Zanelli & Spallanzani, Armsby, Swenson, Scovell, Failyer, Stewart, Henry, Neale, Stubbs, Wilcox, Cook & Neale.

I have also collected the analyses made at large factories, where sorghum sugar has been made on a manufacturing scale. These analyses were made at Washington, D. C.; Champaign, Ill.; Sterling, Hutchinson, Ottawa and Fort Scott, Kans.; Helena, Wis., and Rio Grande, N. J. The results of these analyses show far more conclusively than those of the small samples the general character of the sorghum juices which have been manufactured into sugar in this country during the last seven years. The following is the average of the means of all the analyses:

Sucrose	8.54	per cent.
Glucose	4.59	"
Total solids	15.19	"

The mean co-efficient of purity of these juices is 56.2 per cent., and the percentage of available sugar, on the basis of difference between per cent sucrose and sum of the percentages of other solids, 1.89. On the basis of an average extraction of 60 per cent of the weight of the cane in juice, the yield of sugar per ton of cane for the time indicated, supposing there was no loss in manufacture, would be 22.68 pounds. These figures need no comment; they show beyond any question that the failure to make sorghum sugar profitably in this country has not been due alone to defective machinery nor lack of skill, but chiefly to the quality of the sorghum cane which has been used.

These practical results are strongly in contrast with the conclusions of the committee of the National Academy of Sciences, who, basing their statements on the results of the analyses of small samples of carefully cultivated canes, reached results which in no manner represent the actual data of experience. This committee say: "These analyses have shown the constitution of the juices of each variety at the successive stages in the development of the growing plant. They not only confirm the well known fact of the presence of sugar in the juices of these plants in notable quantity, but they also establish beyond cavil, what seems surprising to those who have not examined the facts, that the sorghum particularly holds in its juices, when taken at the proper stage of development, about as much cane sugar as the best sugar cane of tropical regions."

The danger of basing data for a great industry on the results of the analyses of small plots of sorghum, produced under exceptionally favorable circumstances, is increased when it is done by such high authority. But what shall we think of the care exercised by the committee in forming its conclusions on this matter, when we find them at the same time endorsing the cornstalk sugar lunacy in the following terms?

"In 1880 over 62,000,000 acres of our land were in maize, or 38 per cent of all the cultivated land of the United States. The amount of sugar thus apparently lost, calculated on the results obtained at the Department of Agriculture in the last three years, is equal to the present product of the entire world"

I will add that the committee were extremely modest, in considering the basis of their conclusion, to limit the cornstalk sugar to the whole sugar production of the world. The amount of cornstalks, on the basis of their computations, was over 500,000,000 tons. The mean percentage of sucrose in stalks, calculated from the percentage in the juice, namely, 11.6, is a little over ten per cent. The total quantity of sugar, therefore, which was wasted in the cornstalks for that year would be 50,000,000 tons. But this is a theoretical computation. Let us take the actual yields which the committee found had been obtained; they say:

"It will be seen that in successive years, there was also obtained from the stalks of common maize, after the ripened grain had been plucked, sugar at the rate of 900 pounds to the acre.''

At 900 pounds per acre the yield upon the above calculation for the 62,000,000 acres would be 55,800,000,000 pounds, or 28,800,000 tons. Since the annual production of sugar for the whole world is only about 6,000,000 tons, it is seen that by a failure to utilize the means of wealth which have been so carefully pointed out, we waste every year a quantity of sugar more than four times larger than the whole product of the world. Those of us who have been brought up on a farm and know by experience the exceptionally juicy and saccharine character of the cornstalk when the grain is fully ripe, can appreciate the explanation which the committee make of Mr. Thom's failure to produce sugar from cornstalks, namely: "It is possible if the maize had been allowed to mature, in place of being cut when the ear was in an immature state—fit for canning—the result might have been different." *Credat Judaeus Appollo!*

The above opinions show the danger of forming conclusions which, from insufficient data, or from those which are partial, are not safe guides to the whole truth.

There is one fact, however, which is emphasized in the analytical data, and which demands careful attention. It is seen by numerous analyses of the juices of a single or a few stalks of sorghum that they are often very rich in sugar. The question therefore arises, may not a whole crop of this kind be produced? In illustration of the fact above cited, I call attention to the means of seven analyses of sorghum juices made at Fort Scott from September 19 to October 5, 1886:

Sucrose	13.72	per cent.
Glucose	2.60	"
Total solids	19.76	"

With such cane juices, although they are not as pure as the average sugar cane juice in Louisiana, it would not be difficult, in my opinion, to make sugar profitably.

The data which I give above are easily duplicated by the analyses of many other chemists, but the fact that sorghum sugar cane in exceptional circumstances, contains large amounts of available sugar, has long since been settled.

In contrast with this I will cite an equal number of analyses made at Fort Scott in the same circumstances as above, namely, from September 16 to October 13:

The means of the seven analyses are as follows:

Sucrose	6.56	per cent.
Glucose	7.82	"
Total solids	18.26	"

It seems almost incredible that two sets of analyses so entirely different in their results could have been made on samples of cane grown in the same locality and taken in identically the same manner. This remarkable fact discloses the great difficulty which the sugar-maker working on sorghum has to encounter, namely, the entire unreliability of his raw material. The worker in sugar cane and sugar beets is reasonably sure of his material; what it is to-day it will likely be to-morrow, and so continue sensibly until the end of the season. Unhappily the sorghum sugar worker has no such assurance. The same variety of cane, in the same degree of maturity, and often in the same field, will show the most surprising differences in the sugar content of its sap.

M. Leplay has called attention to the gradual deterioration of sorghum when grown successively for a number of years in France, and ascribes it to admixture with broom corn. This deterioration of the cane, however, has been noticed where no admixture with broom corn has been possible. At Rio Grande the average percentage of sugar in the amber cane when first grown, six years ago, was 11; during the year 1886 it was less than 6 per cent. In several hundreds of acres of this cane, the juice was so poor that no attempt was made whatever to convert it into sugar.

These remarkable variations in the content of sucrose in sorghum cane, and the fact that what sucrose is present in certain common circumstances is likely to rapidly suffer inversion, are points which render it impossible to predict in any given case, financial success in attempts to manufacture sugar. Looked at from the side of physiological botany, this tendency of the sucrose in sorghum to rapid change is of great interest. The question naturally arises, is the sucrose of sorghum a plastic material, a reserve material, or waste. It is not probable, from reasons which I give in the paper of which this is an abstract, that the sucrose in sorghum is a plastic material. Is it a reserve material? The sucrose which is deposited in the seeds of plants, in tubers like the sugar beet, and in sugar cane, is doubtless a true reserve material, and, by its decomposition, helps the growth of the succeeding plant. But the sucrose in sorghum seems to have no such function. It can in no way aid the incipient growth of the next plant, for that plant grows from a seed. As far as any use in the economy of the plant is concerned, the sugar in sorghum appears to be absolutely worthless. It seems, therefore, that the sucrose in sorghum is purely a waste material, as much so as an alkaloid or a resin. In the cases where sucrose is a true reserve material, as in seeds, in tubers, and in sugar cane, we find there is no tendency for it to disappear until the needs of the new plant require it. The sucrose remains, for instance, unchanged in the sugar beet until the new growth begins. The same is true in a higher degree, of the sucrose in seeds. The fact, therefore, that in sorghum all traces of sucrose may disappear in a few days, shows that its office is radically different. The development of sucrose in sorghum is an accidental function, or, rather, an adventitious function. It goes on usually *pari passu* with the formation of the starch in the grain, and the content of the sucrose in the plant, and its quantity is at a maximum at the time its starch formation is completed. The chief cause of the variation of the sucrose in the sorghum, therefore, is found in the accidental or adventitious nature of its formation; in other words, its independence of the life history of the plant. These variations in the content of sucrose, due largely to the causes above mentioned, are one of the chief obstacles hindering the financial success of the sorghum sugar industry in this country.

YIELD PER ACRE.

In the same manner in which I collected the analytical data which have been given, I have compiled the reports of the yield of clean canes per acre. The data thus collected extend over a number of years, and represent the average product of many thousands of acres.

The average of the mean of all the data is 7.97 tons per acre. It has already been seen from the analytical data, obtained from manufacturing establishments, that the average quantity of available sugar per ton has been 22.68 pounds. The amount of sugar per acre, therefore, which the sorghum crop of this country, taken as a whole, has been able to produce up to the present time, is a little over 180 pounds. It is useless to hope for a commercial success in sugar-making when the yield per acre is so low. In the light of the foregoing facts there is no longer any wonder that every manufacturing enterprise, looking to the production of sorghum sugar, has proved a failure.

COMPARATIVE EXPERIMENTS WITH SORGHUM AND SUGAR CANE.

For the first time in the history of sorghum sugar-making, an opportunity was presented at Fort Scott in 1886, to try under identical conditions, the relative merits of Louisiana sugar-cane, and sorghum, as sugar-producing plants. The light, which this trial has thrown on the vexed problem, has served to illuminate many points which were in obscurity. A candid study of the results of the experiments will set at rest all doubts as to the relative merits of those two sachariferous plants.

The mean composition of the juices, 70 analyses in all, expressed from small quantities of sorghum cane, during the entire season at Fort Scott, was as follows:

Sucrose	9.34	per cent.
Glucose	4.10	"
Total solids	16.94	"

The theoretical available sugar in juice, calculated on difference between sucrose and other solids, was 1.74 per cent. The theoretical yield of sugar on 85.5 per cent extraction, allowing for 5 per cent loss in manufacture, was 28.26 pounds per ton. The actual yield of sugar obtained on 85.5 per cent extraction was 21.6 pounds. The small samples of cane above mentioned were taken in such a way as to represent as nearly as possible the general character of cane entering the mill. It would be idle to claim, however, that in nearly 3,000 tons of cane, varying in such a marked manner, as has already been set forth, such a selection of 70 samples could accurately represent the composition of the whole. The mean character of the cane would be more accurately represented by taking samples from each cell of chips and analyzing the juice from them. Such samples were taken on twelve different days, from October 15–27, and each sample represents the mean composition of 10 tons of cane. The mean composition of the juice from these 12 tons of samples was as follows:

Sucrose	7.28	per cent.
Glucose	3.74	"
Total solids	14.80	"

Theoretical percentage of available sugar in juice, none.

A still better idea of the nature of the juices worked for sugar at Fort Scott can be had from a study of the diffusion juices themselves for the entire season. In all 76 analyses of these diffusion juices were made. The samples were collected as follows: from the diffusion juice discharged from each cell a measured quantity was taken. After ten cells had been discharged the samples were mixed and subjected to analyses. The results of the analyses are, therefore, a true index of the character of the diffusion juices for the entire season. The means of the 76 analyses are as follows:

Sucrose	5.10	per cent.
Glucose	3.07	“
Total solids	11.47	“

There is one point in the above data to which I desire to especially call your attention. It is shown that the percentage of available sugar in the diffusion juices for the entire season was, none. This juice, according to the methods of estimating its value in common use, not only would not yield crystallizable sugar, but, on the other hand, would have had a large quantity of sugar added to it before any could have been obtained from it in the ordinary process of manufacture. The theoretical available sugar in the juice is a negative quantity, namely, —1.27 per cent. Therefore the theoretical available sugar per ton for 85.5 per cent extraction was—21.72 pounds.

We turn now for comparison to the data with identically the same processes employed to make sugar from sugar-cane.

The sugar-cane, on which these trials were made, was cut in Louisiana October 25-30, and diffused at Fort Scott November 6-7, 1886. The mean composition of the juice from this cane was as follows:

Sucrose	10.62	per cent.
Glucose	1.78	“
Total solids	14.38	“

The mean composition of the diffusion juices from the above cane was:

Sucrose	7.16	per cent.
Glucose	1.23	“
Total solids	9.86	“

The purity co-efficient of the mill juices was 73.8, and the purity co-efficient of the diffusion juices 72.6.

Such was the character of the sugar-cane from Louisiana, with which such favorable results were obtained. The contrast between the yield from this sugar-cane and from the sorgum work at Fort Scott is most striking. In this contrast the sugar-cane employed appears to have had a high sugar-producing juice, and yet this sugar-cane was much inferior to that which is usually produced in Louisiana.

The records of Bulletins Nos. 11 and 15, which are devoted to a study of the sugar-cane of Louisiana, will show how inferior in quality was the cane worked at Fort Scott. In speaking of these experiments with sugar-cane, the editor of the Revue Agricole, published at Port Louis, Island of Mauritius, in the issue of June, 1887, page 163, says:

"Finally at Fort Scott, Mr. Wiley has obtained satisfactory results by the employment of diffusion and carbonation, with canes which one ought not to think of employing in the manufacture of sugar, because of their poor quality. It is to be regretted that he did not operate upon canes of a mean richness, that is, containing from 15–16 per cent. sugar, because it is certain that the results would have been much better."

It is thus seen that in the eyes of practical sugar-makers in the tropics, the sugar cane employed at Fort Scott was of an extremely bad quality. What, then, would these men say of the character of the sorghum canes worked at the same place? Surely, on this point, there can be but one opinion, namely, that these canes were totally unfit for sugar-making.

The theoretical per cent. of available sugar in the Louisiana cane was 6.86 to 85.5 per cent. extraction, the yield per ton, theoretically, would be 115.3 lbs. The actual yied per ton was 144 lbs. Without discussing further the details of the experiment with the sugar-cane, I desire to call your attention to the following points:

1 Sorghum canes manufactured at Fort Scott gave a yield of 21.6 lbs. sugar per ton.

2 Louisiana sugar-cane, manufactured at the same place, by identically the same processes, and under identical conditions, save that the temperature of diffusion was 20° higher, gave 144 lbs. sugar per ton.

The sorghum cane, therefore, grown at Fort Scott, was seven times less valuable for sugar-making than the sugar-cane.

I am fully convinced of the fact, however, that had the machinery at Fort Scott been perfect, so that the sorghum could have been promptly worked at maturity, the quantity of sugar it would have made would have been greatly increased.

There is one point in the above resumé of especial interest. It is seen that the temperature of diffusion with the sugar-cane was 20° higher than that used with sorghum. It is also seen by the ratio of glucose to sucrose that the process of diffusion with sugar-cane had no sensible effect in diminishing the quanity of sucrose which it contained; in others words, converting it into glucose. This fact is incontestable. It, therefore, follows, that if sorghum cane is in fit condition for sugar-making, there is no possibility of its sucrose becoming inverted in the process of diffusion, especially when this process is carried on 20° lower than that mentioned for sugar-cane. It follows, therefore, that if the process of diffusion did invert the sucrose in the sorghum cane at Fort Scott, it was because this cane entered the diffusion battery in an unfit condition for sugar-making. This, unfortunately, to a large extent, was true, as I have fully set forth in Bulletin No. 14. In the light of the above facts, it will be seen how absurd is the claim, which has been made, that the sorghum crop work at Fort Scott was exceptionally rich in sugar—richer, even, than the sugar-cane of Louisiana.

A writer of the Chicago Journal of Commerce, under date of July 6, 1887, makes the following remarkable statement, after quoting the results of a single analysis on an armful of sorghum cane:

"Now the above shows in each ton of cane 238.5 lbs. total sugar, of which 169 lbs. were available. Such was the average crop of cane, according to the very best, and, indeed, the only method by which its value could be ascertained."

It is upon such statements as these that the erroneous impressions, which are current in many localities, in respect of the sugar-producing properties of sorghum canes are based.

In the forgoing pages I have endeavored to set forth, in their true light, all the facts, which thirty years of investigation have discovered in respect of the sugar-producing qualities of sorghum. I have not omitted any which have come under my observation, and which have any importance in the discussion, different in kind or degree from those which have been cited. It has not been my object, since I have been investigating this subject to bolster up any pet theory, nor to dispute any that others may entertain. As a public official, as well as a private citizen, I am under moral obligations to tell the truth about every subject that comes under my investigation.

In the failures which have attended the attempts to make sugar from sorghum I have not lost hope nor faith.

While I have never shared the extravagant belief of some, I certainly have never cherished the pessimistic notions of others. I have said, on more than one occasion, and I repeat it here, that the success of the sorghum sugar industry is now rather a question for the agronomist than for the manufacturer. I am fully convinced, that had I had sorghum chips at Fort Scott, of the same composition and quality as the chips of the sugar-cane worked there, I would have made the same quantity of sugar per ton. I believe every intelligent, informed and unbiased man will hold the same opinion.

I have not discussed here the methods of manufacture, because such a discussion is foreign to the object I had in view. I may say, however, that there is pratical unanimity on one point, namely, that diffusion will take the place of milling. In the case of sorghum, this implies some method of economically cleaning the cane, for diffusion can never be a succcss until the blades, sheaths and seed are carefully removed. The Department of Agriculture is now conducting two sets of experiments on the manufacture of sugar from sorghum, one at Rio Grande and one at Fort Scott, and at both places we have high hopes of attaining success. Experience has taught me, however, that it is not wise to predict success in such matters; but there are, nevertheless, just now, good reasons for being hopeful. These experiments, however, have nothing to do with the great problem of producing a crop of sorghum, rich in available sugar, and in a locality where a sufficiently long season for manufacture can be secured.

In these experiments, however, we hope to solve the chief mechanical difficulties which have heretofore hindered success.

I have carefully studied the data which I have here presented to you, and compared them with the original authorities; I believe you will find them full and exact. The lessons which they teach should be accepted without the bias of preconceived theory, and without the distortion of personal feeling.

Our great hope of success, when the mechanical appliances already mentioned are perfected, lies in the field. A series of experiments should be instituted by our agricultural colleges looking to the development of the maximum percentage of sucrose in sorghum, and to the study of the conditions best suited to preserve this content of sugar reasonable constant. Such a series of experiments carried on under uniform conditions over the whole country, would do more in five years to determine this great agricultural problem than fifty years of disjointed work could accomplish. Much of the success of the beet sugar industry of Europe has been due to a wise selection and improvement of the seed by which the sugar content of the beet, in some instances, has been nearly doubled. There is no reason to doubt that a similar improvement, not, however, to the same extent, could be secured in sorghum cane. Such a series of experiments could be established at small cost, but, to be effective, should be continued through a series of years. The seed of those canes, showing the highest sugar content should be planted, and the selection continued until a maximum of sugar is obtained. In this way it is possible that a variety of cane may be produced which would give a reasonably high percentage of sucrose, which could be relied upon over large areas under culture.

SMALL FRUITS FOR THE FARM AND GARDEN.

BY S. W. GIBSON, OF BELLEVUE.

[Read at the Charlotte Institute, February 16, 1887.]

The subject mentioned to me as the title of an essay to be read before this Farmers' Institute was "Small Fruits for the Farm and Garden." Of course someone must be provided to tell the farmers how easy and pleasant it is for them to have a good supply of the finest fruit from their own gardens throughout the season, and this year it was to be my duty to speak of the merits of the different varieties and to offer again the information which has been presented year after year in catalogues and in all the agricultural and most of the religious as well as secular papers. Now, let me ask you plainly what good this all does. Does any one profit by it? Does the farmer take notes, go home, order the varieties you recommend, and lay out his ground as you have advised? Does he carefully prune and weed and cultivate and harvest as you suggest? Forgive me if I intimate that he does no such thing. He comes up to these Institutes to meet his old friends, to hear the learned professors from Lansing and any others who have become experts in any department of the farm work in which he himself is interested. If his wife and daughters are not with him he tells them on his return home that Mr. So-and-so talked to us about small fruits and told us we might just as well raise lots of them as not, but, he adds, let him try it and he'd find that a man that did his duty by his farm had no time to fool away with garden fruits. Now, while I will freely agree with you that the farmer *might*, if he *would* raise small fruits, I do not at all wonder that he does not do so, nor do I look for any considerable improvement in this direction. The growing of small fruits is a business of itself and very few farmers who undertake to raise a supply, even for their own use, ever accomplish much. Indeed, the question is asked every year, with more and more seriousness, do small fruits pay the man who grows them for market? Parker Earle says that the right man in the right place may yet do reasonably well raising small fruits for the market, but, he says, he had better not try to do anything else. Competition is so sharp, and the markets are so well occupied that only the man who brings a high degree of skill, patience and perseverence can hope to succeed. How many have we all known who have gone into "the small fruit business" with enthusiasm, believing that *they* were sure of success and wealth?

Only a few days ago a man whom I have known in three years as a keeper of a feed store, then of a meat store, and more recently as an expressman, told me with great earnestness that there was no one near Battle Creek who was a scientific fruit man, and that he was going into the business next spring. When I suggested to him that the market was certainly pretty well supplied, and that I knew many farmers were setting berry plants by the acre, and that I looked for a time to come very soon when it would not pay to market berries at the prices they would bring, he smiled knowingly and said that he would have good land close by the town and he could get the start of the others by going at it in a more thorough way. So he and a good many others will go into the business, and in about two or three years they will go out again, generally poorer and wiser.

If any one asks here to-day the question, "do small fruits pay?" I answer that where a man has the right qualities for the business it will pay reasonably well on the average. But let no one commence the business hastily. Let him study well the market, let him be sure that he is willing both to labor and to wait, and then let him begin in a small way and grow into a large business if he can.

What I have said on this point was said partly to point out the difficulties attending the successful growing of small fruits, and now I wish to ask if, under these circumstances, it is strange that farmers fail so generally in their efforts to provide themselves with the berries, currants and grapes which they desire for family use? It is useless to say that the farmer might do so and so. The farmer is a man of many duties. Each field, each animal, each building, fence, and drain needs its proper share of attention. Especially in spring and summer, there seems to be no rest for the farmer's hand or brain. Chores morning, noon and night, with the long hours of field work, leave no leisure for anything but sleep, and hardly that. Under these circumstances what opportunity is there for the care and attention which a small fruit garden so constantly demands? For small fruits are jealous things. Almost every day, certainly every week, they call for attention, and for every time of neglect they hold back some portion of the wished for harvest. The newly set strawberry plant displays its beautiful blossom only to have it removed, the slender runner reaches out only to see if you are ready with your shears or hoe. The drouth of summer, the aggressive weeds, the cold of winter and the late spring frosts, all call for intelligent and rapid action. So the raspberry and blackberry send up their shoots for the shears in little more than a day, and if the pruner comes a little too late they look down on him and nod assent as he confesses that his delay has cost him the harvest.

A day's delay gives the currant worms possession of their food, and everywhere neglect is followed by failure. Call to mind now the fruit gardens of your farmer neighbors. Have they been profitable? Remember how many times you have bought plants of this or that agent, believing for the moment as you heard his soft words that you could succeed if you could once get the right kind of plants. Is not your strawberry patch a mass of grass and weeds? Do not the weeds and sprouts stand and wave their heads above the snow in your raspberry and blackberry fields? If not, then you are the one farmer among perhaps twenty who successfully raises small fruits for his own table.

It seems to me there is nothing much more discouraging than the neglected fruit patches which one sees as he rides through the country. What, then, should we advise the farmer to do in this case? First I would say to the average farmer, who has not already found by trial that he is one of the few that can succeed. If you are so situated that you can with a reasonable degree of convenience and economy, purchase small fruit from a gardener, do so by all means. Raise your sheep, cattle, hogs and colts, and sell your surplus. Market your apples, your wheat, and whatever your experience as a farmer proves most profitable, and then with the money which one hog, or calf, or something of the same value brings you will buy more and better fruit for eating and preserving than you will be likely to secure from your own garden, especially if you purchase your plants of the itinerant tree agent. But if distance from market or other circumstances prevent this, then do not go without small fruits entirely, but provide a small plantation, say one-quarter to one-half acre of fruits suited to your wants, and then cover it with a mulch which will make all cultivating or hoeing unnecessary. Few farmers cannot spare a load or two of straw or stalks with which to cover the ground so that weeds and grass cannot work through. If you depend on the cultivator and hoe you will probably find that you have "bitten off more than you can chew," while you may succeed very well in the way I have indicated. A little pruning and plenty of mulch will secure a very good supply of fruit, and if there is any better way I hope it will be made plain in the discussion which I have been asked to commence.

Mr. ———: What distance apart should raspberries be set?

Mr. Gibson: Cuthbert 6 feet by 2 feet in rows 8 inches wide; Ohio and Souhegan 7 feet apart or 8 feet; blackberries 8 feet apart.

Mr. ———: Can you mulch Cuthberts so as to keep down suckers?

Mr. Gibson: If you mulch deep enough—say a foot deep—even then they would come up some. I never tie raspberries, even Greggs, I pinch off at 2 feet high as long as my patience lasts; 6 or 8 inches deep of mulch—common dry straw—will keep down weeds. Remove mulch from strawberries when plants start in spring.

Strawberries in matted row need no mulch on the row.

Blackberries should be laid down; possibly Snyder would succeed without. My mother had Lawtons which never bore because not protected.

Mulch strawberries in November or December, remove in April, or so much of it as is on the plants themselves. I formerly grew Wilsons and they were ruined by the rust, which does not attack my other varieties. Set strawberries in spring and renew every two years. I would not use muck soil for berries. Have not had experience on such soil.

I use sloping, full quart baskets, which I prefer to boxes, and I use the Desbro crate made in Rochester. I keep runners off till August or September and then allow them to mat, but this year am trying four acres kept clean right through. Cut runners with sheep shears.

Prof. Bailey: We find a sharp spade or sod cutter useful for that purpose and have found no difficulty from cutting the roots.

Mr. Sherman: I know nothing of the business of small fruits but am a farmer and have tried a little small fruit raising and have not found it to pay. So I have not found it to pay to make my own plow beams, etc., etc. I attend to my legitimate farm business and find my hands full with that, and believe in leaving work that is out of my line to those who make that work their specialty. I raise my farm products and sell them and get what little fruit I want and pay for it.

Mr. Stevens, of Vermontville: I differ from the last speaker. I am a farmer and can raise a bushel of strawberries or of raspberries cheaper than a bushel of potatoes.

GARDENING AND SMALL FRUITS.

BY H. C. REYNOLDS.

[Read at the Fremont Institute, February 3, 1887.

As all kinds of vegetables do not grow equally well on the same kind of soil, we should select a diversified soil that is properly under-drained. There should be as wide a range as regards deep and shallow tillage as there is difference in the habits and growth of vegetables, as there are those that grow deep and those known as surface feeders. And what ever depth the ground is worked it should be thoroughly pulverized in order to have an even and uniform seed bed. It must have a generous supply of manure, equally well pulverized and worked into the soil.

Seed for this Northern climate should be of Northern growth, or at least where the season is as short as it is here, as those grown further South in a warmer climate take longer to mature.

Few operations in the garden are so badly managed as the destruction of weeds and grass. Some will begin the season with vigor to keep the plants free and clean, until they are nicely started, then, in the busy season, the plants are left to fight their own way until the crop is spoiled. Others will keep up the fight until the crop is out of danger, and then leave it, feeling assured that they have done their whole duty; but the moment cultivation ceases, a fresh crop of various kinds of weeds will spring up, and in a very short time mature a crop of seeds which will be ready to give the gardener far more trouble another year than would be the labor of continuing the fight until so late in the fall as to prevent all seeds from ripening. By being thorough in this work from time to time we may save a great amount of labor and secure better crops in the future.

THE MULTIPLICATION OF PLANTS.

BY PROF. L. H. BAILEY.

[ABSTRACT.]

[Given at the Hanover and Charlotte Institutes, with the aid of object lessons and magic lantern views.]

PROPAGATION OF PLANTS.*

- A. BY SEEDS.—*Seedage*
  - *a.* Open air seedage.
  - *b.* Confined seedage.
- B. BY BUDS
  - I. On their own roots
    - 1. By undetached parts.—*Layerage*
      - *a.* Stools.
      - *b.* Root-tips.
      - *c.* Stolons.
      - *d.* Runners.
      - *e.* Layers proper.
        - Simple.
        - Serpentine.
        - Chinese.
    - 2. By detached parts
      - 1. By undivided parts.—*Separation* (Bulbs, corms, bulblets, bulb-scales, tubers, etc).
      - 2. By divided parts
        - I. Division.
        - II. *Cuttage* (Cuttings)
          - *a.* Of stems.
            - Growing wood.
            - Ripened wood.
          - *b.* Of rootstocks.
          - *c.* Of roots.
          - *d.* Of leaves.
  - II. On roots of other plants.—*Graftage*
    - 1. By detached scions
      - I. Budding.
        - Shield.
        - Flute.
      - II. Grafting.
        - Cutting.
        - Veneer.
        - Splice.
        - Saddle. Whip. Crown.
    - 2. By undetached scions.—Inarching.

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* Modified from a synopsis prepared by B. M. Watson, Jr., Bussey Institution.

There are three leading reasons why I bring this subject to your consideration: first, because the successful multiplication of plants lies at the foundation of all success in horticulture; second, this matter is not commonly understood in its details among those who have not been especially trained in it; third, the acquirement of taste and skill in this direction usually leads to successful practice and more enjoyment in other horticultural operations. My subject, as outlined to-night, will concern itself with the operations of plant multiplication, rather than with the reasons for those operations or with the selection and breeding of seed-parents.

1. *Seedage.* Seed-saving and seed-sowing are coördinate branches of seed-propagation, but seedage properly includes only a discussion of the latter. In order to properly understand methods of sowing, however, we must know something of seed selection. Pedigree in plants is fully as important as pedigree in stock. Seeds tend to perpetuate the strongest characteristics of their parents. Not only do certain external features of plants have this influence upon the seeds, but the time of the year in which seeds are gathered and the treatment to which they are submitted, have a more or less decided influence. Seeds gathered before they are fully ripe will usually germinate sooner than those of the same kind which are entirely mature. The reason of this is obvious. After a seed is fully formed, the ripening process consists largely in the fixing of carbon, and in the forming of a protective coat. Before germination can take place in this fully ripened seed, the carbon must be liberated and the coat must be softened or broken so that the embryo or germ can protrude itself. One of the first essentials to the liberation of this carbon is water, moisture. The oxygen of the water unites with the carbon of the seed, and the compound escapes, mostly or entirely in the form of carbon dioxide or "carbonic acid." Any substance which will tend to liberate this oxygen more freely, so that the combination with the carbon can be more readily affected, is supposed to hasten germination. Several substances are used for this purpose, especially upon old and feeble seeds. Sometimes seeds are so feeble that such treatment is necessary. We have experimented with several of these substances, with the result, at this time, that soaking twelve or more hours in weak lime water proves the most satisfactory.

The softening of the seed-coats is performed in a variety of ways by nature. Usually the seeds fall to the ground in the fall and are buried under leaves, where the alternate freezing and thawing and the fluctuations of moisture split or macerate the coverings. Some fleshy fruits, as the choke-berry, hang upon the plants during the winter, the fleshy portion perhaps answering the purpose of the soil. There is much difference of opinion as to whether cold is helpful to germination any further than as it aids in cracking the hard coverings. Some contend that in some manner freezing tends to render the liberation of carbon more easy, thus aiding germination. It is a common supposition that peach-pits will not germinate unless exposed to frost. This is not true. There is good reason to believe, however, that frost hastens their germination. It is probably the constant presence of moisture about seeds that are frozen which causes much or most of the good result which follows freezing. In general, however, exposure to frost and moisture have merely a mechanical effect. With nearly all hard coated seeds we must imitate nature in her methods of softening or cracking them. We do this by stratification. This process consists in imbedding the seeds in boxes of clean, sifted sand, for ordinary seeds using strata of sand an inch thick alternating with thin layers of seeds. When the box or pot is filled with these layers, it is set out of doors, or more commonly buried just underneath the surface, until spring. [Here the speaker explained by object lessons the whole method of stratifying.] Walnuts and other fruits of similar size, if in quantity, are buried in a large pile, being mixed in with sand and leaves. Even with the best of treatment, many seeds will not germinate until they have been in the ground two or more years. Most of the bony seeds of shrubs and of many fruits behave in this manner. The experienced horticulturist is able to recognize this tardy character in most cases. Such seeds are simply allowed to remain in the ground until they come up. We have plats at the college which contain seeds which we do not expect to make an appearance for two or three years. We keep these plats clean of weeds and abide nature's pleasure. It is supposed that nature has an object in thus delaying germination, for more seeds can perfect plants if a few germinate each year than if all germinated at once. With certain seeds, seedlings will continue to appear for eight or ten years from a single sowing.

2. *Layerage.* This subject readily divides itself into two parts, natural layerage and artificial layerage. Nature does not rely upon seeds alone, else many of her plants would fail to "hold their own." Perhaps half of our wild plants, other than trees, have auxilliary methods of propagation. The roots spread rapidly in a horizontal direction and at intervals new individuals start from them, forming *stools* or *suckers.* The long and lax shoots bend to the ground and take root at the apex, forming *root-tips,* as in raspberries. If these shoots are weaker and strike the ground below their tip, as in some honeysuckles, dogwoods and other plants, they are known as *stolons.* If herbaceous shoots run along on the surface, taking root at their joints, they become *runners,* as in strawberries and sweet potatoes. These are all natural methods of propagation. When man bends over the stems of plants, securing them to the earth so that they will take root he practices *layering.* Most soft-wooded plants will "strike," as the gardeners say, from the simple contact with the earth. In case they do not, it is a common practice to make an incision through the bark on the lower side of the stem where it meets the ground. This incision begins to heal; a callus is formed from which roots strike out. Layering is usually performed in the spring when the leaves begin to push, but on warm soils it can be performed in the fall with equal success. It should not be performed in summer, otherwise an immature growth will be had which will be likely to winterkill. If layers are put down in spring, they will usually be ready to detach from the parent plant the following spring. All the old, original stem should be removed except enough to carry the root which has formed. In this manner we propagate most shrubby plants which do not take readily from cuttings. It is used for black raspberries, often for currants and gooseberries, and very largely for ornamental bushes. A modification of these common or *simple layers* is the *serpentine layer.* This differs from the ordinary layer only in having two or more points of contact with the earth instead of one, enabling the operator to secure more than one plant from each layer. It is frequently used upon plants whose stems are very long and lax. We have used it this last year with a species of trailing raspberry from the North. When we lay down several strawberry plants from one runner we make a serpentine layer. The *Chinese layer* is very different from these last. It is practiced in green-houses upon plants which have become "leggy" or "toppy," that is, whose stems are too slender and long. The stem is girdled just below the branches, and about this girdle is tied a large ball of moss. Usually a large flower pot is split and put about the stem to hold the moss. This moss is kept moist, and roots soon begin to penetrate it from the upper side of the girdle, When these roots are sufficiently grown, the stem is severed at the girdle and the whole top of the plant,

with its new roots is lowered into a pot, the old "leg" or stem being thrown away. Sometimes individual branches are rooted and lowered in this manner.

3. *Separation.* This is a strictly natural method of plant propagation. Next to seedage, separation is the most universal method of natural multiplication. Man simply employs it, he scarcely ever modifies it. Under this denomination are propagation by bulbs, corms, bulblets, bulb-scales and tubers. These parts detach themselves naturally or nearly so. Propagation by true bulbs is performed in the case of onions, lilies, etc.; mostly with members of the lily family. A corm is a solid bulb, one which is not made up of different layers. The best examples occur in crocuses and gladioli. A bulblet differs from a bulb in being borne upon the stem of the plant above the surface. Examples of these occur in "top onions" and some lilies. Bulb scales are simply the leaves or layers of bulbs. Tubers are of many kinds. They are short, thickened portions of roots or stems. A root tuber is furnished by the sweet potato, a stem tuber by the common potato. Although the common potato is borne under ground, it is but a thickened subterranean stem as shown by its buds or "eyes" and its manner of growth.

4. *Division* is but a step removed from separation; man separates the plant and causes each part to establish itself. We practice division in multiplying rhubarb and many ornamental plants. Division always means a gross dividing of the root. When this dividing proceeds a step farther, so that we divide the stems or other parts into small pieces, we have

5. *Cuttage,* propagation by cuttings. Cuttings are fragments of the plant bearing no roots, or in the case of root cuttings, bearing no small roots. Cuttings are inserted directly in the soil for the formation of roots or, in rare cases, in water. Herein lies the radical distinction between cuttings and grafts. Cuttings are of four leading kinds:

a. Of Stems.—These are again divided into cuttings of growing wood and cuttings of ripened wood. Cuttings of growing wood are mostly used in green-houses and floriculture. Nearly all plants can be made to "strike" from these soft cuttings, however, under careful management. No rule can be laid down to govern the time of making soft cuttings and the manner o treating them. Most herbaceous perennial plants which are started under glass for out-of-door decorations in summer are the products of cutting made in February. Soft cuttings vary in length, but they are nearly always shorter than hard cuttings. They commonly comprise but two joints, being cut close below one joint and above the other or upper one. These are then inserted about half their length in sharp sand, under glass. This sand is necessary, as it affords perfect drainage at the same time that it preserves a moist and loose condition. This sand is usually sifted through a common flour sieve in order to separate all lumps, roots, and bulky organic matter. In ordinary soil such cuttings will rot or "damp off." These soft cuttings usually require a bottom heat, also. They are placed on the benches in the forcing house or green-house, or in a steady hot-bed. The soil should be a few degrees warmer than the air about the cuttings. The philosophy of this is to prevent evaporation from the green, soft stem, and the portion of a leaf which is usually left at the upper joint. The warm bottom stimulates a root growth, rather than a leaf growth. The root growth once established, the leaf and stem growth will come of themselves. Soft cuttings are commonly started close to the glass; that is, the space between the soil and the glass is but a few inches. This arrangement is to check evaporation. The more air there is above the cuttings the more evaporation there will be. It was formerly supposed that these cuttings must be started in the shade, as under a northern roof. Most practical florists now strike them under southern or other roofs with equal ease, taking care to break the force of the sun in the middle of the day by lath screens or muslin.

Hard cuttings, or cuttings of ripened wood, are those used for the propagation of most small fruits. In general, hard cuttings are best when cut in the fall, if properly stored. The first operation of independent growth begins as soon as the cuttings are placed in moss or sand in the fall, and if they do not freeze, it continues during the winter. This beginning of activity is the formation of a callus on the lower end of the cuttings. This callus is a mass of cellular tissue which is deposited for the purpose of healing over the wounded surface. From this callus the roots start. If the callus is well formed before cuttings are planted out in the spring, it will represent a considerable gain in the growth, inasmuch as it must form before roots can start. This same observation will apply to trees which are transplanted in early fall, a practice always to be recommended, unless severe climate or uncongenial soil forbid. In this rigorous climate it is safer, also, to take cuttings in fall, to guard against winterkilling. Cuttings of grapes, currants, quinces, etc., are taken in the fall, just before the weather closes up, and are tied in bundles and placed in a cellar or pit. They are commonly buried half their length in the sand. These cuttings are from six to twelve inches long, the length commonly depending upon the length of the internodes or spaces between the joints. They are planted in the spring by inserting them into the space made by a single thrust of a spade. Usually the top bud is left above ground. As fast as the cuttings are inserted, the earth is stamped firmly against them. Roots will usually start from each subterranean bud. These hard cuttings are sometimes made from wood two years and more old, but ordinarily they are taken from the last growth. In most cases roots start more readily from this recently ripened wood than from that of greater age. Grape cuttings can be taken in November, at the time of pruning the vines, making them from the larger canes of the season. Three buds are left on grape cuttings, usually.

b. Of Rootstocks—Rootstocks are underground stems. They can be distinguished from true roots by the presence of joints, scales, and sometimes of buds or eyes. Quackgrass and Canada thistles propagate themselves largely by roots. A number of herbaceous ornamental plants are propagated by cuttings from their rootstocks; also the common potato.

c. Of Roots—Cuttings of true roots are not often made in ordinary gardening. The most familiar example occurs in the case of the blackberry. Here the roots are cut into sections two inches in length and the sections or cuttings are planted horizontally in sand, being covered an inch or so deep.

d. Of Leaves—Leaf cuttings are employed in propagating certain thick-leaved, ornamental plants. The cabbage can be propagated in the same manner. The leaf is cut into triangular sections an inch or two long with a portion of the midrib or a large vein coming at the point. This point is inserted a half inch in sand, which is kept constantly moist. Sometimes the leaf is not cut but is laid upon the sand and toothpicks stuck through the larger veins at intervals to hold them to the soil. Roots form where there is contact with the earth.

6. *Graftage.*—Next to seedage, graftage is undoubtedly the most important

artificial method of plant multiplication. It divides itself into two general heads, *budding* and *grafting*. In this abstract the latter head alone is considered.

There are several hundred kinds of grafting in practice, each method differing only in some particular of manipulation. Root-grafting is the most important division of grafting to the fruit grower. Great quantities of nurserygrown apple trees and many plum and cherry trees are root-grafted. The seedlings or stocks used for this purpose are usually a year old and are grown on deep, rich soil for the purpose of getting a long, clean root. The roots are cut into pieces two or three inches long upon which the scions of the desired varieties are grafted. This operation is performed in-doors in winter when labor is cheap, the stocks having been dug up and heeled-in in a cellar before winter set in. When the union is made it is bound rapidly with waxed string, and the graft is then ready to be laid away in sand or moss until weather permits it to be set out of doors. The waxed string with which the graft is tied should be strong enough to hold the parts together and yet weak enough to allow it to be very easily broken by the operator. We have found the best string to be No. 18 cotton yarn. This comes in balls. The balls are dropped into a kettle of melted grafting wax and allowed to remain ten minutes, by which time the wax will have entirely permeated them. When in use, the ball is placed in an ordinary grocer's ball-holder which is hung above and a little to the right of the operator. The old-fashioned whip or tongue graft is the one almost universally employed in root-grafting. This method has very decided faults. The heart wood of the scion and stock do not usually unite readily and there often results a cavity in the center of the stem. At the College we have used the veneer graft extensively of late. In this method the hard wood of neither the scion nor stock come in contact. The sap woods are applied to each other, insuring a perfect union.

Question: Can a plant start up except from some seed or germ?

Prof. Bailey: No. Many of the spores or germs of small vegetable life float in the air about us ready to grow whenever favorable conditions offer. Such are the germs that make mould or rot on fruit. On top of Mt. Blanc the air is free from germs and fruit will keep without canning.

Question: Is sand better than vegetable mould for propagation of house plants?

Prof. Bailey: Yes.

Question: How old is clover seed good?

Prof. Bailey: Don't know. Much of what is sold is over two years old; a certain per cent loses its vitality each year.

Question: How is it that old weeds turn up on new land 100 miles away from settlement?

Prof. Bailey: It is hard to say; they come in hay or along with household goods and in a myriad of unsuspected ways.

Question: How about chess? Farmers say they don't know how it gets into their wheat.

Prof. Bailey: I often wonder how so many weeds get in my corn.

Question: Do bumble bees fertilize clover?

Prof. Bailey: Yes. One reason of light early clover seed is because the bumble bees are not working much. In Australia they could raise clover but not clover seed until they imported bumble bees.

You can't raise squash under glass unless you carry pollen yourself from flower to flower.

Honey bees do not fertilize clover as their tongues are not long enough.

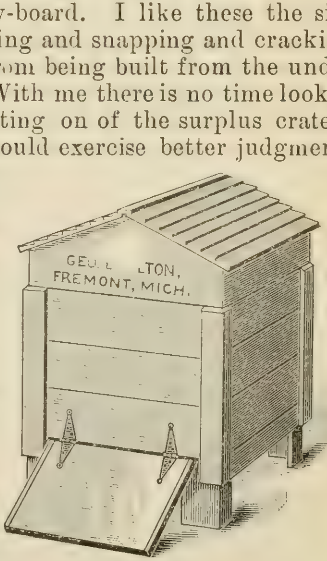
PRODUCTION OF COMB HONEY.

BY MR. GEO. E. HILTON, OF FREMONT.

[Read at the joint meeting of the Farmers' Institute and Fremont Progressive Bee-keepers' Association, February 4th, 1887.]

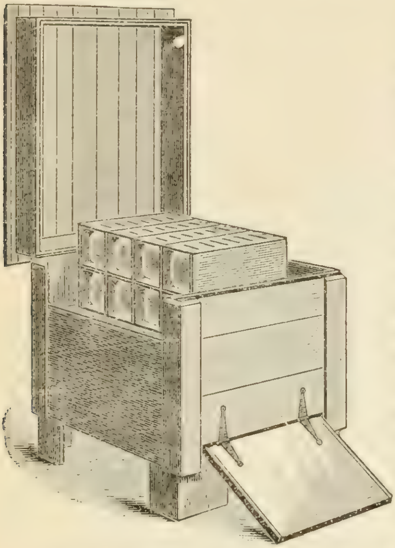
As I have made the production of comb honey a success for the past eight years, a review of what I consider the best methods even at this time of year, may be of value the coming season. Should it give you any new ideas whereby you can increase your profits in this our chosen pursuit, then my object in writing this paper will be accomplished.

The first and great important factor is a hive full of bees at the commencement of the honey flow. And here a paper of interest could be written on spring management. The question is often asked by the amateur, "When is the proper time to put on the surplus cases?" The majority of the bee books say as soon as you see little bits of new comb being built along the top bar of the brood chamber. My answer is, as soon as the surplus season opens; in this latitude it is at the opening of the blackberry and raspberry blossoms, followed closely by the white clover, which is our main source. Previous to this your crates should all be prepared with sections filled with full sheets of thin foundations, (I prefer that made on the Given press.) You should also be provided with a zinc queen excluding honey-board. I like these the size of my surplus crate. This avoids all propolising and snapping and cracking of crates in taking off, and all brace combs from being built from the under side of sections to the top of brood frames. With me there is no time looked forward to with more interest than the putting on of the surplus crates; neither is there a time when the apiarist should exercise better judgment. Approaching a hive we examine it closely, and if up to the standard, namely: well filled with brood and working bees, we remove all bits of comb from the top bars, lay on our zinc queen excluding honey-board, and put on one crate containing twenty-eight, $4\frac{1}{4}$ by $4\frac{1}{4}$ by $1\frac{3}{4}$ in. sections. All things considered, I think this size the best. Perhaps the next hive we approach we have not been able to build up to the standard. This we will leave until we find another not up to the standard. We will remove best combs of brood and young bees, (being careful not to take the queen,) remove the four combs containing the least brood from No. 1 and change places with them, using judgment in making up the brood nest, keep-



Hive Closed.

ing the brood in the center of the weak colony, and the combs containing the least brood in the center of the now strong colony. Proceed as before, and put on your surplus arrangement, and out of two weak colonies you have one ready for the honey flow, and my experience is that you will receive more honey and of a better quality from this one than you would from the two if left to build up during the honey flow, besides you have saved yourself the trouble of going over the apiary so many times as required in the bit of comb plan.


Hilton's Hive Open, Showing Surplus Arrangement.

We will now consider the apiary supplied with surplus arrangements, and that the bees are well at work in the sections and the busy season is upon us. The sections must now be watched closely, and as fast as the crates are about two-thirds full of honey, raise them up and put an empty one arranged as the first under it; this leaves a space to be filled with combs and honey between the brood nest and the partially filled crate on top. This is just as the bees don't want it, and as a rule, just as they are coming to a point where the swarming fever is liable to overtake them, they find this great hole in their midst, and it is surprising how they will double their energies to fill this cavity; at the same time they will be finishing the upper crate. It is my custom at this stage of the proceedings to go over the apiary every week. My crates are so arranged that I can draw out all the finished sections, replacing them with empty ones, keeping the crate containing the least honey at the bottom and the one nearest completion at the top. This prevents the bees running over the finished section, and removing it as fast as finished gives it you in its virgin whiteness. This system largely does away with the swarming impulse just at the height of the honey flow; but occasionally a swarm will issue in spite of everything. In this case what shall we do to prevent the cessation of honey storing in the surplus department?

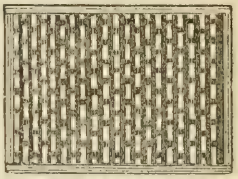
My plan is as follows: As soon as the swarm has left the parent hive, take off the surplus arrangements, lift out all but one comb and carry them to a new stand. Put in from four to six empty frames, according to the size of the swarm, filling the rest of the brood chamber with a division board put on the zinc honey board and surplus cases just removed, and close the hive. Proceed with a basket and shake the swarm from their alighting place into it, and dump them in front of the hive from which they came; watch them closely until sure you have the queen, and the work is done. The remaininb bees at the alighting place, as soon as they discover the absence of the queen, will return to the old stand; so will the field bees remaining on the seven combs you have carried to the new stand, and all the bees in the fields returning home gives you the same working force you had before. The desire for swarming is satisfied and the work in the sections goes on as though nothing had happened. Your seven combs have plenty of nurse bees to care for the larvæ in them, and at the same time they are so depleted in old bees that they very seldom send out a second swarm.

And now I want to say just a word in regard to the handling and disposing of comb honey. I have bought considerable honey at different times to sell again, and invariably I am obliged to go over the whole lot and clean up the sections. I am sorry to say that honey is a luxury and not a staple at the present time. Now in times of taking off honey, have the good wife, or sister, or some good, careful girl, at the honey house with a knife or piece of glass, and have her carefully remove all the propolis and bad stains that may appear on the sections; set them away—the best on one shelf and the second grade in another, with a sheet of paper between every two tiers to catch any drippings that may occur, as the honey stains the wood, and the nearer gilt-edge we keep our product the more we shall realize for the same.

Shipping Crate.

In packing for shipment I find no crate giving as general satisfaction as one holding 14 or 16 of these sections. Glassed at each end, they range in weight from 12 to 15 pounds, they stand shipment well, either by freight or express; and the retailer frequently sells a whole crate to a single customer.

In closing, I feel I cannot urge too strongly the use of the zinc queen excluding honey board. I consider it one of the grandest inventions of the age—no brood in the sections, no fastening the sections, crate and all, to the brood frames, thus tearing off the bottom of the section, or lifting the brood frames out by their adhering to the crate; in fact, with the experience I have had with them, I would as soon think of putting on sections without foundation starters as putting on a crate without a queen excluding honey board.



Zinc Honey Board.

Dr. Beal: That queen excluder seems to me good as it excludes bee bread, brood and pollen from the honey sections. Honey raising is the saving of a waste product and also incidentally is of much benefit to the farmer and fruit grower in the fertilization of flowers.

SOME INSECT ENEMIES OF THE BEE.

BY PROF. A. J. COOK, AGRICULTURAL COLLEGE, MICH.

[Reprinted by permission from Gleanings in Bee Culture.]

ANOTHER BEE MOTH.

On the 12th of August last, Mr. J. H. Martin, of Hartford, N. Y., sent me by mail, in a good strong box, some comb, which contained several larvæ of some moth. He stated that these larvæ were quite abundant on his unused combs, but said they did no harm—indeed, he thought them a benefit, as the combs which were peopled by them were undisturbed by the common bee-moth, which, as all know, is really to be dreaded, as it mutilates the combs quite seriously. He asked for name, habits, etc., and wished, if of general interest, that information be given through the bee-papers.

August 20 I visited the apiary of my brother at Owosso, Mich., and found that he had been considerably troubled by the same insects. They were numerous on the combs, and, though they did not mutilate the comb, they did spin their silken cords all over it and drop their fecal pellets in the cells in a way that would not make the comb very pleasant to the bees. My brother also found the two insects, this small one and the larger well-known bee-moth, *Galleria cereana*, working side by side. Some of these were carefully placed in a breeding bottle, and now I have the moth. We conclude, then, that eggs may be laid in July or August, the larvæ found at work in August, September and October, and the moths found from October till spring. There is, doubtless a spring brood.

The insect proves to be *Ephestia interpunctella*, Hubner, or *Tinea zeæ*, Fitch. Riley, in his 9th Missouri Report, p. 31, refers to this insect as *Ephestia zeæ*, and calls it a wax-feeding larva. Lintner, in his 1st Report, speaks of *Ephestia interpunctella* as the cabbage-moth. The same author, in his entomological contributions, speaks of *Ephestia interpunctella* as existing in both Patagonia and the United States. In Vol. VII., p. 23, Ontario Entomological Society, this insect, under the name *Ephestia zeæ*, is referred to as introduced by the grain exhibits at the Centennial Exposition at Philadelphia.

Dr. Fitch, in his second N. Y. Report, p. 320, describes this moth in all its stages. He was not aware that it had been previously described by Hübner, and so called it *Tinea zeæ*. He speaks of it as feeding on flour, and as especially common in stale Indian meal. Dr. Fitch also gives a good figure of the moth. This author concludes that the moth might exclaim with Barlow, in his hasty-pudding:

> "All my bones were made of Indian corn. Delicious grain!"

Dr. Fitch also calls attention to the fact that this insect, like the larva of the grain-moth, *Tinea granella*, fills the substance on which it feeds with a web.

The correct name of this moth is *Ephestia interpunctella*. As it has never had a common name, so far as I know, I would propose that of lesser bee-moth. I have heard of it so generally this summer from several besides the two persons already referred to, that I think it is quite partial to honeycomb, or rather to what is stored in the cells of the comb. It feeds on the pollen in the cells, and injures the comb only by its web and filth, which I think would soon be cleaned out by a good, vigorous colony of bees. W. J. Ellison, Stateburg, S. C., writes me that this insect does much harm in his State, as it spreads its web on the comb honey in the sections.

DESCRIPTION.

The full-grown larva, in general color and size, see Fig. 1, resembles the apple, or codling moth larva, very much. It is about $\frac{5}{8}$ of an inch long, and pink in color. The head is brown, with darker jaws and lateral edges. It bears a few light-colored hairs. The dorsal shield of the first thoracic segment is also brown, with about $\frac{1}{3}$ of its area on each side much darker than the central third. This shield is crossed by a central dorsal light-colored line which passes on to the head, when it soon forks and extends to the base of each jaw. It also bears a few white hairs. Below this shield on each side, just in front of the spiracle, is a piliferous dark spot. Six rows of similar spots extend the entire length of the larva. The six spots divide the dorsal portion of each segment into nearly equal parts, though the dorsal space is a little broader. The lower spots on the thoracic segments are in front of the spiracles; on the other segments, below them. On the third from the last segment, the middle of the three spots is larger, and has a central white spot. The two dorsal spots run together on the two last rings in most of the larvæ. The under side of the body is light-colored.

The pupa is formed in a slight cocoon of light-colored silk in the cells of the comb. Very likely, if not confined it would leave the comb and seek some crevice or other concealed position. It is 5-16 of an inch long, and of the usual form and color.

The imago, Fig. 2, or mature insect, is a prettty little moth, and is accurately represented as to size, form, and markings, by the figure. It is ½ an inch long, and expands 11-16 of an inch. The base of the primary, or front wings, is straw color, while the opposite ends for something more than one-half their length have brown and dark scales intermingled, so the color is brownish purple. The brown prevails almost exclusively at a small central area, forming a brown spot. Two less distinct brownish spots are seen just back of this spot near the internal margin, the inner one being the larger. Two indistinct brownish lines extend parallel with the outer margin of these wings. The outer margin is fringed with dark gray. The posterior, or secondary wings, are light-colored, with a satin-like reflection, and broadly fringed with the same color. The thorax and abdomen are colored like the secondary wings, except that there are more dark scales, which slightly shades the color. The eyes are black; the head and antennæ dark gray, with a distinct bluish reflection.

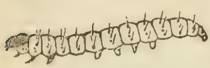


FIG. 1.

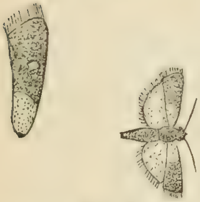


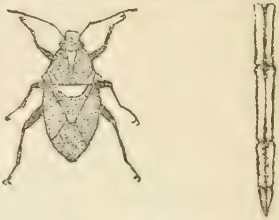
FIG. 2.
Ephestia Interpunctella
—Larva and Moth.

These moths, like the common, or old bee-moth, *Galleria cereana*, Fab., belong to the family *Pyralidæ*, or snout moths. They are so named because of their projecting palpi, which, as they reach out in front of the head, look not unlike a snout or nose. These palpi are marked features of all moths and butterflies, or, as we may say, of all lepidoptera. They are the mouth organs that usually curl up beside the tongue or maxillæ, of such insects, reminding us somewhat of whiskers. In these pyralids they project forward instead of curling up.

As already stated, these insects feed only upon the bee-bread, or pollen, and will probably do little harm, except where they work on the surplus comb honey. They will become more and more common, and will attract most attention after hard winters, when unused combs lie thick about the apiary.

A NEW BEE ENEMY.

Mr. W. J. Ellison, of Stateburg, S. C., sends me a bug which sucks the blood and life from his bees. As I have never heard of this bug as a bee-enemy, I am much interested in it. Indeed, I knew of only one bee-killer among the bugs proper, before this one came; that is, the curious stinging bug, *Phymata erosa*, Fab., which is fully described and illustrated in my Manual, last edition, page 322. This new bee-stabber—I will christen it the bee-stabber—as Mr. E. says that it stabs the bee and sucks it dry, is known in science as *Euthyrhynchus Floridanus*, Linn. As would be inferred by its generic name, it has a very powerful four-jointed beak, which is shown magnified in the figure. From the specific name given by the great Sweedish naturalist, Linnæus, we should expect it to occur in Florida as well as in South Carolina. Probably the one described by Linnæus came from Florida. This insect was also described by Th. Say, as *Pentatoma emarginata*. His description of this insect, like all his descriptions, is very accurate, which will be seen by looking at the figure which I send, which is drawn natural size. "From Georgia. Body purplish blue." This one is greenish blue. "Rostrum pale fulvous; thorax at posterior angles, with a cylindrical emarginate spine; scutel having three obicular fulvous spots; feet at base pale fulvous; beneath, under the rostrum, region of the feet, middle of the ventral base, anus, and triangular lateral spot, fulvous. Length one-half inch."



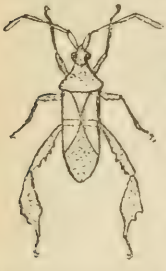
Bee-Stabber—*Euthyrhynchus Floridanus.*

"Female.—Thorax with the anterior and lateral margins and longitudina line in the middle dull fulvous; the two basal spots of the scutel sometimes confluent. Length three fifths of an inch." The one I have from South Carolina, as will be seen by the figure, is a female. Mr. Say received his specimen from Savannah, Georgia.

The near relatives of this insect are often predaceous, and so are very valuable. Usually, however, few are so brave as to attack bees, and are wholly our friends, as they destroy many of our most destructive insect foes. This one, no doubt, also does much good, and it is only to be regretted that it has this one sin to account for. I presume, however, that it will not draw very heavily on the apiary, and so from its general good character we may excuse this one dereliction. Should it so prey upon our bees that we feel the loss, then I could only suggest the same remedy that I have recommended for the "bee-hawks"—the large dragon flies that attack and destroy our bees—to capture them by hand. I should be very glad if Mr. Ellison could send me a dozen of these handsome bugs. Indeed, I am glad to get insects from bee-keepers everywhere and all others, and will gladly describe, name, and will explain their habits. In sending insects be sure to put them into a close, strong box, so that they may not be crushed in transit. It is not necessary to give them any ventilation, nor usually to furnish them any food. Caterpillars should have some of their food in the box with them.

SOUTH CAROLINA BEE-STABBER.

I inclose a very accurate figure of a bee-destroying bug received from Mr. W. J. Ellison, Stateburg, South Carolina. The figure gives accurately the size, form, and markings. It is a very graceful, slender bug, and belongs to a very predaceous group. Their entire life's business seems to be to hunt out and destroy other insects. The scientific name is *Leptoglossus phyllopus*, Linn. The specific name "phyllopus" is very appropriate, as it means leaf-like foot, and doubtless was given to this insect by the great Swedish naturalist because of the expanded posterior tibia. The general color is brown, or in some species nearly black. Right here I wish to praise Mr. Swinson's mode of sending insects. He sent several of all ages, each in a little hole by itself, and all in a long narrow pine block. I hope others will take pattern after him. A beautiful pure white line extends across the wing-covers, as shown in the figure, which gives a ready means of identifying this bloodthirsty bug. The spines on the posterior femora and tibiæ are also interesting. Say had this species from Florida, and described it as albicinctus, because of the characteristic white line. Glover says, this insect kills the destructive cabbage-bug at Evergreen, S. C. This cabbage-plant bug, *Strachia histrionica,* is very destructive, as well as quite beautiful. Thus we may conclude that this species that I am now describing does much good, and is well worthy our fostering care, unless it makes too free with the bees, which I hope will not be the case.


Another Bee-Stabber.

Our Southern bee-keepers will easily identify this insect by the white band and broad posterior legs. I am glad to get these, and all species of insects. I wish they would always come in such good shape as did these. Will Mr. Swinton report if he finds these bugs very destructive to his bees? I should not expect such to be the case. Later Mr. E. writes me that this bug does not attack bees at all, but is very destructive to tomatoes. This is very curious and interesting.

SOUTHERN BEE-KILLER.

Mr. P. Hill, Narrows, Brevard Co., Fla., sends a large bumble-bee-like robber-fly, of which he writes: "I take the liberty to send you a fly which you will please send to Prof. Cook. I caught it with a bee in its mouth. He is very strong with his mandibles, readily biting through the thick skin on the inside of my hand. I should like the name and habits of this fly."

Mr. A. W. Tufts, of Musson, La., sends to me, through Gleanings, two similar flies, except they are slightly smaller. The one from Mr. Hill might be compared in size to a queen bumble-bee ; those from Mr. Tufts, to the smaller worker. Mr. Tufts writes: "He is a worse enemy to the honey-bees than the mosquito-hawk, or great dragon-fly. When he is disturbed he flies a short distance, alights, and flies again. He will go right to the entrance of the hive for his prey, thus differing from the mosquito-hawk, which takes his on the wing."

I have received these same robber-flies from several other bee-keepers of the South this season, and on previous years ; and as I have not received these flies from the North, while the long slim black robber-flies are also destructive North, I will call these the Southern bee-killers. As there are no good illustrations of these flies, so far as I know, I will send a good figure and quite full description.

Mallophora Orcina.

Of these flies, I write as follows in my Manual, p. 319:

"There are two other species of this family, *Mallophora Orcina* and *M. bomboides,* which differ greatly from those mentioned above (species of *Asilus, Erax* and *Promachus,* which are dark gray or black, with long slim bodies thinly covered with hairs). They look more like bumble-bees, for which they have been mistaken."

M. Orcina, the smaller of these Southern bee-killers, is about one inch long, and expands (see figure) 1¾ inches. *M. bomboides* is a little larger. Both are yellow with black bands, and are densely clothed with hairs. The beak is very strong, and it is with this that these marauders are enabled to pierce the thick crust, and suck the life-blood of bee or other insect. It will be remembered that these, with all two-winged flies, belong to the order *Diptera.* All of these insects have their mouth-parts modified into a strong beak with which they pierce and suck. Thus it were more proper to say, perhaps, that the robber-flies, mosquitoes, and horse-flies, stab or pierce, than to say that they bite. These flies have a very strong beak, large strong feet (see Manual, Figs. 175 and 176, p. 319), and very prominent eyes. As intimated by Messrs. Hill and Tufts, these are very ferocious insects. Indeed, they are very lions among the insect tribes, or they would not dare attack the honey-bees. With their close allies, the asilus flies, they do much good, and we have only to regret that both these flies have the unwelcome habit of attacking and killing bees. It is to be hoped that they will never be numerous enough to cause serious anxiety. If they do, we must resort to hand-catching by aid of handle-nets.

MORPHOLOGY OF THE LEGS OF HYMENOPTEROUS INSECTS.*

BY PROF. A. J. COOK, AGRICULTURAL COLLEGE, MICHIGAN.

According to our modern philosophy regarding the origin and development of animal organs and organisms, we should look at such organs as are much used in the animal economy to find extremes in modification. Thus among mammals the teeth are most modified and very important in systematic mammalogy. For like reason the ornithologist looks to bill and feet in his study of families and genera. With the laws of variation and adaptation before us, we should expect to find modification carried to extremes among hymenopterous insects. The life functions of these insects are so wonderful and varied that a maximum differentation of organs and structure is required for their execution. The chief tools used by these hymenopterons are the legs and mouth organs, and it is to the former that I invite attention.

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* This paper was read before American Association for the Advancement of Science, at the New York meeting, August, 1887.

Let us first consider the anterior or pro-thorocic legs of the honey-bee. We first notice (Fig. 1) a strong and interesting modification in the basal tarsus and tibial spur, which modification is known as the "antenna cleaner." At the base of the first tarsal joint and in the angle between it and the tibia is a short, hollow semi-cylinder. The concave surface of this cavity is smooth except at the outside margin, where there are from seventy-eight to ninety projecting hairs, which under the microscope remind one of the villi of the small intestines of mammals. These teeth, like hairs, projecting as a fringe, form a most delicate brush. The tibial spur is so modified as to resemble a very short handled razor, the blade of which is for a wide space facing the tarsus, a most delicate membrane, and this blade forms a sort of lid to the cavity just described. When the leg is straight this lid barely reaches the cavity; but when the first tarsus is flexed upon the tibia it serves as a cover to the cavity and really closes it.

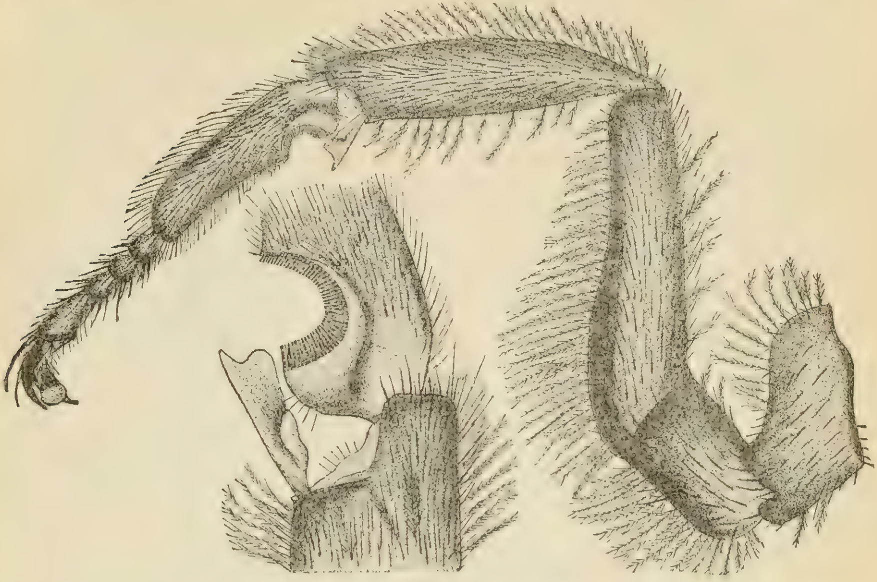

FIG 1.

This peculiar structure is found in both sexes and in the abortive females or workers of social bees, in all other bees, in all wasps so far as I have examined, in the Mutillidæ, in ants, in all the families of parasitic hymenoptera except the Chalcids, while in the Cynips, Cynipidæ, Saw flies, Tenthredinidæ, and horn-tails, Uroceredæ, we find it nearly or quite absent.

We find the "antenna cleaner" in all species of bees—Apidæ—even in the curious species like the male of Megachile (Fig. 2.), where the whole anterior leg is remarkably modified. In the bumble-bees species of the genus Bombus we find the antenna cleaner almost exactly like that of the honey-bee, except the part which I have termed the blade, in the modified tibial spur has its back more

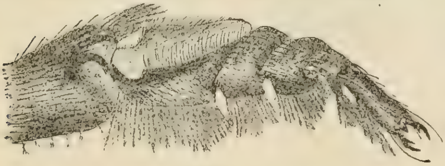

FIG. 5.

extended, and the whole back of the blade and the extended point thickly set with short spines, reminding one of the serrations on the antennæ of many beetles like the Buprestids. In the Carpenter-bees Xylocopa there is no variation from the type of the bombus except the serrated margin of the blade is still more marked. In the female of the tailor-bees—Megachile—the extended point and serrations are both absent, and we have again the form of this organ in the honey-bee. The number of the teeth in the cavity however, is less, there being from forty-five to fifty. In Osmia and Andrena (Fig. 3.) the arrangement is much as in the Xylocope; in Nomada the serrations are less spinous and more scattered, while in the beautiful species of Angochlora the cavity is quite shallow, the blade of the spur narrow, and the spines on the back and point of the blade slim and hair like.

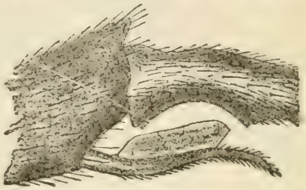
FIG. 3.

In the several families of wasps we find this pollen cleaner well developed, and in some cases quite modified from the same in bees. In the paper-making wasps—Vespidæ, it is much as in the lowest bees—Nomada and Angochlora. The cavity is more shallow than in the honey-bee, the membranous portion of the blade is quite narrow, and the appendages on the point of the blade are hair-like, though those near the base remind one of saw teeth.

In sand-wasps—Bembecidæ—this organ is much as seen in bees and paper-making wasps; though the point of the blade is very long, and the back and point both thickly set with fine hairs.

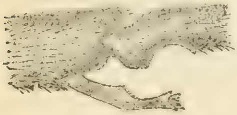
FIG. 4.

In all species of mud wasps, belonging to the family Sphegidæ, Fig. 4, we find an interesting modification in the spur. Here the membranous portion of the blade is nearly obsolete, while its inner margin is concave and fringed with a toothed brush much as seen in the cavity, though the teeth are shorter. The end of the blade is blunt, and bears from five to eight heavy appendages, which, when magnified, look like so many fingers.

In the beautiful mud wasps of the family Pompilidæ, this apparatus is much as in the Sphegidæ, except that the cavity is more shallow. The fringe on the spur is peculiarly fine and beautiful. The spur is pointed, the point being flat and margined on both sides with spines.

In the Mutillidæ this organ is specially well shown. The type is that of the bees and Vespidæ, as the blade is membranous and without the fringe. The back and both sides of the point, however, are covered with a row of spinous hairs.

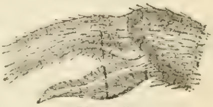
FIG. 5.

In the ants—Formicidæ—Fig. 5, the cavity is shallow and the fringe well-marked in the cavity and on the spur where it is double, and while this brush is beautiful it is not widely different from the hairs on the point of the blade, and on the remaining part of the basal tarsus.

In Ichneumonidæ, Fig. 6, and Braconidæ we find this antenna cleaner

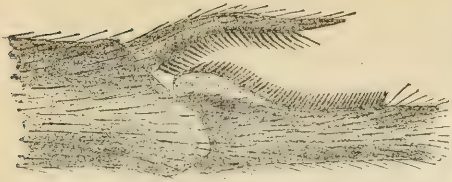

FIG. 6.

less developed, though still present. The cavity is hardly more than an inclined plane, the rise at the distal end being very slight. The spur is marked by a distinct concavity, and the fringe is present in the cavity and on the spur, though the brush in case is made up of coarser hairs than are found in bees or wasps.

In the species of Chrysididæ we find this apparatus more perfect than in the Ichneumonidæ. The cavity is deeper, the spur concave and both show the comb or fringe well marked. The species of this family are unique in that the concave spur is fringed to the very point of the blade.

In the minute Proctotrypidæ the antenna cleaner is even less developed than in the Ichneumon flies. The cavity is almost wholly obsolete, the spur is only slightly concave, and the hairs forming the brush are hardly different from the other hairs of the leg. In the Chalcid flies—Chalcididæ—the cavity is wholly absent, and the only suggestion of this apparatus is in the slightly curved spur. The brush is also obsolete. The same is hardly less true of the gall-flies—Cynipidæ. In the saw-flies—Tenthredinidæ—Fig. 9, there is no hint of the cavity on the first tarsus; but a slight concavity of the spur, with the membrane just visible, still suggests the "pollen cleaner." In the horn-tails—Uroceridæ—the only reminder we have of the antenna cleaner is in the slightly curved spur. The membranous part of the blade is wholly wanting.

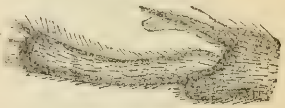

FIG. 9.

In the study of this apparatus I have been very much interested to note how persistant is its type within each family. I have carefully examined very numerous specimens, and I think we could, from the study of this organ alone, arrange the species of Hymenoptera, with very few exceptions, in their respective families. The same is also true in many cases of genera. We shall not wonder at this as we come to study the function of the organ and note its great importance.

No one who has studied bees closely can doubt for a moment the functional importance of the antennæ. As touch organs, they are most delicate and wonderful. The work of the hive bee is largely performed in total darkness. Yet very intricate operations are carried on with unerring exactness. This is only possible through the aid of these very sensitive tactile organs—the antennæ. There is hardly less doubt that the antennæ are the scent organs of insects. And with Hymenopterous insects, especially of the higher families, the sense of smell is of exceeding importance. It has been thought also that the antennæ serve as organs of hearing. We see then that it is of the highest importance that these organs be kept free from all dust. But the very habits of most Hymenopterous insects, visiting, as they do, flowers laden with pollen, as do all except the lowest families, or digging in the mud and dust, as do many bees and wasps, tend to soil the antennæ. And it is no more necessary for the microscopist to brush the lenses of his objectives than for the bee or wasp to dust its antennæ.

That the function of the apparatus just described is to brush or free from dust the antennæ is easily proved by experiment. We have only to imprison a bee or wasp on the window pane of our room, and quietly dust its antennæ with lime or flour, when we will see it pass an anterior leg forward, draw an antenna through the cleaner, after which the bee will pass the fore legs now foul with dust between the brushes formed by the soft hairy inner faces of the basal tarsi of the middle legs. This will be repeated several times, when upon examination the antennæ will be found entirely freed from the troublesome dust. In case of the wasp, as Polistes annularis, the antennæ are cleaned the same as just described except that the leg or antenna cleaner is cleaned by passing it between the jaws instead of between the middle legs. As we are sure of the function of this beautiful apparatus we do not need to refer to the wonderful correspondence in size of the cavity in each separate case, with the antennæ of the same insect, which would be added proof if such were needed as to its function. I will also state that I believe I have found an antenna cleaner in some beetles, especially carabids. In these cases the cavity and lid are both on the tibia a little distance towards the body from its farther end.

In the honey-bee on the outer end of the tibia, just opposite the pollen cleaner (Fig. 1.) is a small brush. This has been regarded by some as a cleaner of the antennæ cleaners; but we have seen that the latter organs are cleaned in another way. I have never seen these brushes used to clean the cavities, though I have observed closely. The fact that other bees, wasps, ants, etc., have no such brush makes me doubt such function.

The branching, fluffy hairs which cover the upper part of the fore leg (Fig. 1) of the worker honey-bee are like the same in other legs of the same insect, of use in gathering the pollen. From these hairs the pollen is combed off and transported to the pollen baskets.

Opposite the side of the basal tarsus which contains the cavity of the antennæ cleaner of the bee (Fig. 1.) is a comb formed of quite stiff hairs. This is used to free the hairy compound eyes of the bees of dust, pollen, etc., and also to comb the pollen off the lighter hairs. The former function may be observed by close observation, as the bee is seen to wipe its pollen-begrimmed eyes, much as the common house fly is observed to rub its eyes, face and antennæ.

The middle legs of bees are covered with the compound hairs to the end of the tibia where a prominent tibial spur (Fig. 8) is seen, but no more prominent in the honey-bee than in other bees and in wasps. Indeed it is even larger in drones than in the worker bees. It has been claimed that this is the lever with which the bee pries off the pollen mass into the cell; but the fact that these are no more prominent than in other

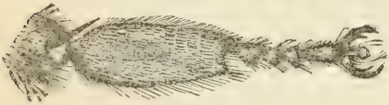
FIG. 8.

insects where there is no such function to be performed, and the fact that the stiff hairs which point outward at the ends of these and all the legs are better fitted for this work, gives reason to question the accuracy of this view. On the inside of the first tarsal joint of the middle legs (Fig. 8) is a fine brush thickly set with hairs, which, as we have already seen, is used to clean the antenna cleaner, and, as I often noticed large masses of pollen adhering to this brush, I am led to the conclusion that these are hands or claspers that aid to bear the pollen to the baskets on the posterior legs. The lower or outer hairs of this brush are spine-like and doubtless aid as already suggested in pushing the loads of pollen from the legs into the cells of the comb.

Upon the first three joints of the posterior legs, the coxa, trochantes and femur (Fig. 10) the soft, compound, pollen gathering hairs are well shown. In the honey bee the tibia and first tarsus are wonderfully developed. On the outside (Fig. 9) are concavities for holding the pollen. These shallow cavities, one in each of the joints, are bordered with coarse hairs, which serve as so many stakes to aid in holding the large pollen masses which the bee is often seen carrying to the hive. Opposite the concavity of the tarsal joint (Fig. 10) on the inside are to be seen nine or ten rows of beautiful yellow hairs, which form as many combs or brushes, which serve to collect and transport the pollen from different parts of the bee to the pollen baskets. If a bee is captured while collecting pollen, these beautiful brushes will always be found with more or less pollen adhering to them. Of course the combs of one leg are used to fill the pollen basket of the opposite legs. As before stated, this work is in part performed by a similar but less perfect arrangement on the corresponding portion of the middle legs.

Between the tibia and first tarsus of the posterior legs of the honey-bee, Figs. 9 and 10, is a very curious joint, reminding one of a steel trap or the jaws of an

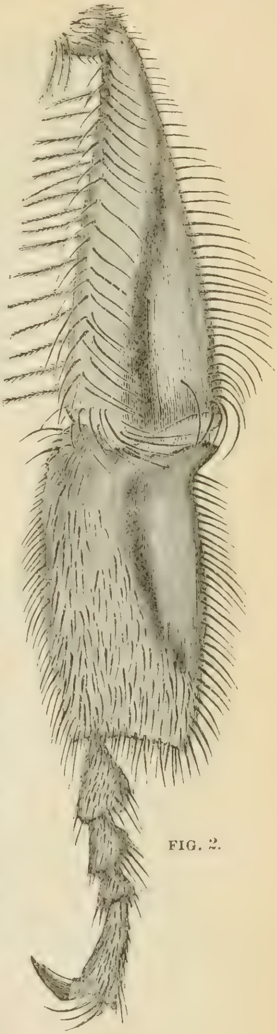

FIG. 2.

FIG. 9.

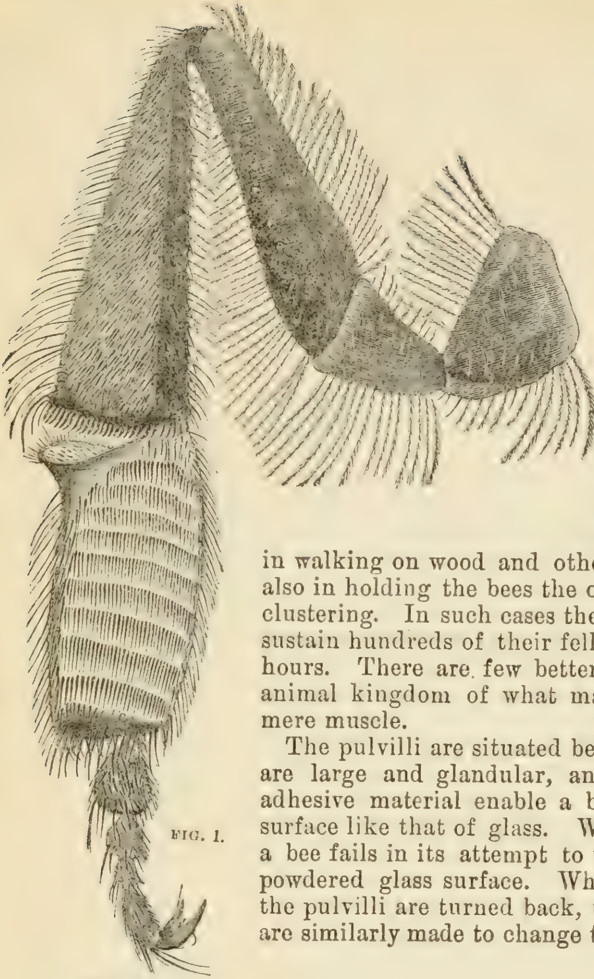

FIG. 1.

FIG. 10.

animal, the tibial or inner jaw of which is well covered with quite pronounced teeth. This is used to grasp the delicate wax scales from the pockets, where they are secreted beneath the abdomen and transfer them to the mouth, where they are kneaded into material suitable for comb.

The claws and pulvilli, which terminate the feet of all Hymenopterous insects, Fig. 8, are specially well developed in bees. The former have a strong tooth and are useful not only in walking on wood and other similar surfaces, but also in holding the bees the one to another in case of clustering. In such cases the uppermost bees have to sustain hundreds of their fellows, and this often for hours. There are few better examples in the whole animal kingdom of what may be accomplished by mere muscle.

The pulvilli are situated between the claws. They are large and glandular, and by secreting a viscid adhesive material enable a bee to walk up a smooth surface like that of glass. We thus understand why a bee fails in its attempt to walk up a moistened or powdered glass surface. When a bee walks on wood the pulvilli are turned back, when on glass the claws are similarly made to change their position.

NOTES ON NOXIOUS INSECTS.*

BY PROF. A. J. COOK, AGRICULTURAL COLLEGE, MICH.

There are few, if any insects which cause more serious anxiety to our gardeners than do the Anthomyia. From some peculiarity of these insects, possibly scent, unsavory taste, or perhaps their protected position in the earth, and in the tunnels which they form in the roots which are burrowed by them; they seem quite free from attack of parasitic or predaceous insect. So, unlike most of our injurious species, each year, whether dry or wet, warm or cold, finds the cabbages, onions and radishes well stocked with these destructive maggots.

In our works on practical entomology, we find these insects mentioned, and described as three separate species: *Anthomyia ceparum*, which works, on the onion, *A. brassicæ*, which attacks the cabbage, and *A. raphani*, which furrows the radish. It will be remembered, that in a paper which I read before this society at its last meeting, I questioned this classification and suggested that all might belong to one species. After another year's study, observation and experience, I am fully confirmed in the opinion expressed a year ago. I believe they are trimorphic. True, the flies reared from maggots on the radish are usually darker and more hairy than those reared on the cabbage, while those from the onion are larger and quite yellowish. Yet we find in rearing a large number of forms that these characters are not constant. It is utterly impossible to distinguish many of the radish and cabbage flies. The flies from onions are generally more characteristic; but we have secured several that are good examples of the radish or cabbage type.

Again, we find that we can easily rear maggots from eggs laid on the cabbage, by transferring them to the radish, and *vice versa*. Eggs transferred from radish and cabbage to the onion did not fully develop, although some reached the puparium. These coarctate pupæ were very small. In all these cases the plants fed upon were transplanted in pots and taken to the laboratory. The onions did not bear transplanting well, and it is more than possible that the feeble plants caused the ill success. A few eggs from onions were removed to cabbages and radishes, but none developed.

For some years, previous to last year, our cabbage bed at the Michigan Agricultural College had suffered seriously from the ravages of the Anthomyia. This bed had been planted year after year in nearly the same place, and close alongside a large onion bed. Close inspection each year, however, failed to find any maggots on the onions. Last year the cabbage bed was removed about ninety rods from its previous location, to the opposite side of a large apple orchard; and the place where the cabbages were planted the previous year was occupied with onions. The cabbages in this case were entirely free from attack, while the onions were almost a total failure. The closest observation could detect no essential difference in the maggots working on these onions and those found on cabbages hard by. Of the adult flies reared from these onion maggots, while most were larger, and a little lighter in hue, some of them were hardly distinguishable from flies reared from maggots infesting the cabbages. One maggot was found working in the the succulent growth of a raspberry cane, which was also precisely like the onion and cabbage maggots. The fly reared from this maggot was the typical cabbage Anthomyia.

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* This paper was read before the American Association of Agriculturists, at the August, 1887, meeting in New York.

Thus it will be seen that we have three excellent reasons for the opinion that all these Anthomyia are varieties of one single species. First, the fact that they intergrade perfectly; secondly, they can be removed from one plant to another, as from radish to cabbage, and thrive as well; thirdly, the fact that though none could be found in 1885 on onions, yet in 1886 an entire onion bed was thoroughly devastated. If these were cabbage flies, which in the absence of cabbage plants attacked the onion as a second and necessary choice, then we easily understand and can explain this curious wholsale onslaught.

It will occur at once to all that this is a matter of great practical moment. If these flies are varieties of one species, and though preferring radishes or cabbages, will in the absence of these plants attack onions, it is of great importance that the gardener should know it.

REMEDIES.

After several years of close experimentation, I am of the opinion decidedly, that the only practicable remedy in the hands of the practical man against these Anthomyia, is change of place of the plants, or covering the plants so as to exclude the flies. It is true, that I have killed these maggots both in the garden and on potted plants in the laboratory, by use of the kerosene and soap mixture, and also by the use of bi-sulphide of carbon. Yet upon a thorough trial I am persuaded that these remedies cannot be made practicable. Difference in soils, seclusion of the maggots, which bore quickly out of the reach even of these insecticides, make their use uncertain, and them unsatisfactory insecticides in this warfare.

As suggested above, we have been entirely successful now for two years, by removing the cabbages ninety rods from where any of these susceptible plants had been previously raised or grown. True, an orchard intervenes, and other susceptible plants remained in the old position. But we are certainly warranted in the opinion that by making the distance of the removal great enough, we should escape this evil. Some plants might be planted in the old places as lure patches, which could be pulled and destroyed before the maggots were fully grown; though this would not be desirable, in case the circumstances permitted a sufficient removal. If we can starve the pest, it would be very wise and desiaable. Of course it is possible that other plants would be selected in case of the entire removal of those named.

We could also secure early radishes by growing them in cold frames under musquito netting, or thin factory or cheese cloth, and thus certainly fence out these flies. This method is surely practicable and inexpensive, though it would require some care.

We are also experimenting with paper collars resting upon the ground and closely encircling the plants. In some cases we used adhesive paper, such as is sold in the drug stores to trap flies. We thus hope to secure the eggs, and keep them from hatching. The number of eggs we have secured from a single plant is astonishing. They were numbered by hundreds. We have not tried this method sufficiently as yet to recommend it. After another year I can speak definitely as to its practicability and value.

THE PLUM CURCULIO.

As is well known, the apples in certain sections of our country are very grievously deformed, almost to ruination, by a curculionid which stings the fruit in May and June. Wisconsin, especially, has suffered serious injury of this kind, as shown in the deformed, gnarly fruit shown from that State at Grand Rapids in 1885. The insect which works this destruction has been referred to in the public press as the plum gouger *Cocotorus scutellaris*, Lec. (*Anthonomus prunicida*, Walsh), and also as the apple curculio, *Anthonomus quadrigibbus*, Say. While in attendance upon the Wisconsin Institutes last winter, I arranged with several of the leading horticulturists of that State, to furnish me with some of these curculionids. Last June I received a large nmber, and what was my surprise to find that they were our old enemy, the plum curculio, *Conotrochelus nenuphar*, Herbst. Since then I have made investigation in Michigan, where I find the "Little Turk" equally guilty. From what I have observed, it would seem that this weevil prefers the plum, and will attack that to the almost entire exclusion of the cherry, apple, peach, etc., if it can consult its own choice. But in the absence of the plum, these other fruits suffer attack, and are ruined. An orchard with many scattering plum trees, showed no curculio traces on its apples, pears and cherries. One twenty rods distant, with no plum trees, showed many of the characteristic "crescents" on apples and pears, while another similar one nearly a mile distant, showed still more of the scars and doformities which attend the punctures of the plum curculio.

From these observations I believe it will pay every orchardist to mingle plum among his apple, peach and cherry trees. This will lure the curculio from these trees, and by a faithful practice of the jarring method at the same time, secure a bountiful harvest in his plum crop. As the plum is a short lived tree, it will be necessary to replant often, but the quick, early fruitage of these trees is no small compensation for this frequent planting.

LONDON PURPLE.

In 1880, the year that this society was organized, I showed that London purple and Paris green were safe and effectual specifics against the coddling moth. Each year gives added proof of the value of this remedy. I have only a few suggestions to urge in this relation at this time: First. London purple is to be preferred to Paris green. It is more easily mixed with water, remains mixed longer, injures the foliage less, and is considerable cheaper than is Paris green. To be sure, it is a little less strong in arsenic than is Paris green, but the proportion is so high that we still get more arsenic for the same money in London purple than in Paris green. White arsenic, I think, should never be used. It is not much cheaper than London purple, and from its color, accident is much more likely to attend its use.

Second. The London purple should be used early, before the apples are larger than peas, or as soon as the blossoms are well off the trees. If deferred later many of the larvæ will have passed into the fruit, and so escape harm. Thus early, one application is usually quite satisfactory. If a second is to be made, it should be after an interval of about three weeks. A heavy rain might make the second application very desirable.

Third. The mixture should be very dilute. One pound of London purple to one hundred (100) gallons of water is strong enough. This permits a thorough application, so that each and every fruit shall receive a particle of the poison, and yet the foliage will not be injured.

Fourth. The liquid mixture should be applied with a powerful force pump. This dashes the liquid on the tree, and it so scatters that every apple receives the death potion. This point is equally important in applying liquid insecticides of every kind to all kinds of insects that infest our plants.

In this connection I wish to commend the Lockport force pump, which is run with gearing attached to the wagon wheel, so that the horses that draw the wagon also work the pump. I have also found the Climax nozzle, made by A. H. Nixon, Dayton, Ohio, a very valuable auxiliary in spraying vegetables. It furnishes a spray equal to the Cyclone nozzle, and at the same time permits more force, which is very desirable.

APHIDÆ, OR PLANT LICE.

For the past two years, with their unparalled drouths, the aphides have been exceptionally numerous, and correspondingly destructive. As suggested last year, the kerosene and soap mixture is a sure remedy for these destroyers. Dashed on to the lice with a powerful force pump, it is wonderfully effective. To make this I churn a quart of soft soap, a quart of water and one pint of kerosene till all are permanently mixed. I then dilute with water till the kerosene forms one fifteenth of the whole. In place of the quart of soft soap, we find that we may as well use one-fourth pound of whale oil soap.

We were very pleased to learn from our experiments made in April last (April 11th), that this liquid is equally powerful to destroy the plant louse eggs, before they hatch. We also found it very efficient when applied to plant lice just after they hatch. This is a very important matter, as it is much easier to make the application thorough before the leaves put forth, and before the lice are domiciled in the curled up leaves. As we have seen before, success in this case depends upon thoroughness, and this thoroughness, especially in treating large trees, is very difficult after the foliage is fully developed, so here it is peculiarly true, that the early bird catches the worm.

At the Tree Oaks Institute, Prof. Cook, speaking on the same subject of injurious insects, said:

CODLING MOTH.

It is often stated that a pan of sour milk placed in an apple tree will catch great numbers of the codling moth. This is an error. It will catch many moths, but not one codling moth. Neither will lights in the tree entrap them.

Now, when the apple is the size of a pea, the moth lays its egg in the flower end of the apple. It hatches and the larva eats through the apple and comes out, and in June hides itself as a cocoon. In ten or twelve days the perfect moth comes out and lays a second crop of eggs. When these go into cocoons, though the weather be as hot as in June, and all other conditions apparently the same, yet the insect does not mature until the next spring.

Now how to fight them? The band method farmers have not time for and will not practice. The hog method is better but does not take all the worms as all wormy apples do not fall for the hog.

ARSENITES.

The third remedy and the one I urge is the use of arsenites, London purple or Paris green. I found out in attacking the canker worm that it was effective also for codling moths.

I had two crab-trees near together, both badly affected with codling moth. One I treated and one I did not. The one that I treated had no wormy apples, while the apples on the other were nearly all wormy. Then to test the presence of poison, as to whether it stays on the fruit so as to make it dangerous as human food, I took a tree and used Paris green to great excess, and five or six weeks later I tested by microscopic examination, and could see no poison. I then took 100 apple eyes to Dr. Kedzie, and he by analysis proved that there was no poison present.

Where does the poison go to? Many wall papers colored with Paris green are exceedingly dangerous from the constant escape of the poison into the air, and in the open air the winds and rains quickly carry down the poison to the soil, where its influence is so slight as to be of no consequence. As to when to apply: Do not wait until the apple is larger than a pea. How apply? By Whitman's fountain pump, made by J. A. Whitman, of Providence, RhodeIsland. It costs $7.50, and 60 cents for express. This will do for a few trees. For a large orchard a rig costing $20.00 or $30.00 is necessary. A good apparatus is made by Field, of Lockport, N. Y.

The cyclone nozzle is very valuable for spraying the poison. Also, A. H. Nixon, of Dayton, Ohio, has still better nozzles. This poison solution must be dashed on with the utmost force. One pound of poison to one hundred gallons of water is abundance of poison. I am inclined to think that one pound to two hundred gallons might be enough, if you are careful to stir the mixture continually. This is a prime condition of success. Do not let the poison settle to the bottom. Now, at the same time that you are killing all of these codling moths, you are also killing a great variety of other injurious insects, the destruction of which will more than repay the entire cost. One application will do great good if used early enough, though two, one made three weeks later, will be more effective. One pailful of the mixture is enough for a large apple tree. Keep stock out of the orchard until a heavy rainfall has followed the poisoning. The Field apparatus keeps the solution constantly stirred automatically. This must be attended to or your work will be thrown away. An effective method of stirring is to put the nozzle of your hose into the solution and then pump vigorously.

APPLE MAGGOTS.

Another enemy of the apple is the apple maggot, called in New York the pin-worm. They go all through an apple, and often forty will be in one apple. They only work in fall apples. The perfect insect, resembling a small house fly, comes in June or July and lays her eggs anywhere on the surface of the apple and the larvæ when hatched eat their way into and through the substance of the apple in any and all directions. The hog remedy is the only one that I know.

CABBAGE BUTTERFLY.

The butterfly comes early and lays green eggs on the leaves and it is very difficult to see them at first. They hatch into green caterpillars which eat voraciously. A second crop comes later and eats all through the head of the cabbage. The best remedy is Buhach, also called Pyrethrum and Persian Insect Powder. That from California (The Buhach Manufacturing Company, Stockton, California) is fresher than that from across the ocean and is consequently better. It is not poisonous. Dust it on or dash it on with the $4.00 Woodason spray bellows. Don't use arsenites. It is not safe. Never use them on cabbages. One tablespoonful of Buhach to two gallons of water, or one tablespoonful to twenty pounds of flour is the best proportion for applying.

CURRANT SAW-FLY.

This fly saws a hole into the leaf of the currant and lays its eggs there, where they hatch in little green worms which soon burst their skin because they have become too small for them, and during their growth they moult five times. White hellebore applied in the same manner as Buhach will destroy them, and there is no danger of its poisoning the fruit if used early enough. Never use Paris green. It is not safe.

HOUSE FLIES AND LICE.

House flies may be taken care of by darkening every room except the kitchen and exposing some sweet substance in that room soon after dinner. Then at bed time use Buhach, making the air dusty with it. In the morning sweep them up from the floor and put them in the stove, and if that is not done some of them will revive after a while. So of lice on poultry, dust Buhach under the feathers, and on cattle rub your hand against the hair and dust with Buhach, but this must be done every three or four weeks. Woodward recommends crude kerosene which is effective, but the cattle don't like it. A better thing is one-half pound of the cheapest tobacco. Put in a pail and turn hot water on it, and as soon as the water is cool enough to put your hands in take a cloth and roll up your sleeves and go over the animal thoroughly. Ten minutes will treat an animal.

KEROSENE EMULSION.

If made with milk this injures leaves—the milk is of no use. A better thing is soap emulsion with kerosene, either soft, hard, or whale oil soap. One quart soft soap, and 1 pint kerosene and 7 pints water makes a good proportion. It will kill plant lice every time. Don't gently sprinkle from a watering pot, but dash on with a spray bellows. Why not use Paris green? Because plant lice and bugs will not eat it. A bug is an insect with a beak which it inserts for sucking out juices and it doesn't get any poisons that you put on the surface. But this kerosene emulsion will fit any place where arsenites and Buhach are inadvisable or useless.

The cherry or pear slugs is a near relative of the currant saw-fly, and about the time of ripe cherries and in September they are on the trees. Buhach or kerosene emulsion will always kill them. Road dust or any dry earth sometimes will do so, but does not seem to be always effective. Freshly slacked lime will also kill them with certainty if dusted thoroughly on the trees.

Parasites are little insects that live within other insects, and on such minute beings are we more dependent in our contest with our insect enemies than upon any other agency. Fifty-three million dollars injury was done to the wheat of Illinois in one year by the Hessian fly. The next year the wheat of Illinois was saved by the work of these little parasites. We have even gone to France to import parasites to fight insects with.

On shade trees where leaves are eaten use arsenites. If Buhach is effective use it, and where arsenites or Buhach cannot be used use the kerosene emulsion.

Question: Is the Nixon nozzle better than the Cyclone, Boss or Boston?

Prof. Cook: I think so; it throws a finer spray, and with more force.

Question: How would you treat insects on buds of walnut trees?

Prof. Cook: Spray with the arsenites if the tree is not too large.

Question: How treat the rose chafer?

Prof. Cook: Mr. Carman says Buhach is dead shot for them.

Question: Why is fine spray better. Is it for any other reason than economy?

Prof. Cook: Yes; too much poison kills the leaves. The least that you can apply will kill the insects.

Question: Will the Cyclone nozzle fit any pump?

Prof. Cook: It can be fitted by a rubber tube to any pump.

Question: How about the onion maggot?

Prof. Cook: Kerosene emulsion if used early enough and persistently enough will succeed. It will kill all it touches. But as they hatch every few days you must use the remedy as often; and as the worms soon burrow into the substance of the onion or the radish the application must be made before they have got in out of reach.

THE POWER OF WIND-MILLS.

PROFESSOR R. C. CARPENTER.

[From Rural New Yorker, July 30, 1887.]

Experiments in developments of power; power of mills overrated; Smeaton's experiments; small mills proportionately less effective than large; work of a mill.

In 1880 I spent considerable time in determining the efficiency of two wind-mills. Each mill had a ten-foot wheel made of wooden slats set in the ordinary way. One mill was new and turned very rapidly in a light wind, the other was old with bearings in bad shape, and gave very poor results. The following were the results of the best mill:

Number of revolutions per minute.	Gross power developed each minute in foot pounds.	Net power developed each minute in foot pounds.	Gallons of water raised one foot each minute.	Gross horse power actually developed.	Velocity of wind.		Horse power that would have been developed.	
					Miles per hour.	Feet per second.	Wind 8 miles per hour.	Wind 20 miles per hour.
55.2	1656	1104	132.5	1-20X	12	17.6	1-70	¼
54.8	1644	1096	131.5	1-20—	11	16.8		
42.8	1284	856	102.7	1-25	10	14.7	1-85	1-5

By consulting the meteorological tables compiled at the college, I find that the wind blows faster than eight miles per hour only about one-fifth of the time, while it is less than eight miles per hour fully three-quarters of the time. The wind is less than four miles per hour more than one-half the time.

These results of actual trial show that the power of the wind-mill is very much less than claimed by the agents or even generally supposed. Thus in the region of Southern Michigan the ten-foot mill cannot be counted as averaging 1-70 of a horse power. This will be sufficient to raise about fifty-seven gallons of water one foot per minute, or about two gallons twenty-eight feet per minute. Two gallons per minute is nearly four barrels per hour and about ninety barrels per day of twenty-four hours. In this region the windmill will not run, for lack of wind, but little more than one-half of the time, and there are few ten-foot wheels that will raise, on the average, even when running, one gallon per minute, simply because the wind is too light.

The philosophy of the windmill was investigated by Smeaton in the 17th century and by Professor Rankine in our present century. Smeaton made a great number of experiments on the mills then in existence, and these experiments form the basis of most of the theories of the wind-mill. In Smeaton's time the wind-mill was the principal power available for pumping or grinding grain, as the steam engine had not then been perfected. The mills of his time had canvass sails, and we find from his experiments that they were more effective than our present wooden slat mills. This is, of course, reasonable.

Smeaton found that a wind-mill thirty-one feet in diameter in a breeze of nine miles per hour, would develop one-horse power of work, or would raise about 4,000 gallons of water one foot each minute. He found the power varied with the cube of the velocity of the wind and also with the square of the diameter of the wheel. Small mills are not proportionately as efficient as large ones, because the friction is a greater proportion of the force developed.

I was interested in a statement made in the Rural New Yorker of June 18, by Mr. Whittemore, of the actual work of a wind-mill. His statement was that a 12-feet wind-mill in a breeze of 10 to 12 miles per hour, raised 150 gallons per hour; the water is raised 44 feet, and pumped a distance of 550 feet, doing work no doubt equivalent to raising water 60 feet. The work of the mill would then be two and a half gallons raised 60 feet, or the equivalent of 150 gallons raised one foot per minute; this amount would weigh about 1,250 pounds. As a horse power is 33,000 pounds lifted one foot each minute, the mill would be doing work equivalent to about one twenty-sixth part of a horse power.

HORSE POWER OF STEAM ENGINES.

PROFESSOR R. C. CARPENTER.

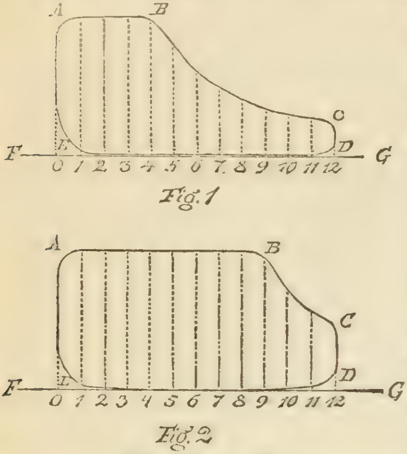
[From Rural New Yorker.]

Meaning of "horse power;" horses and engines as motive powers; mode of ascertaining horse-power; steam expansion; nominal and actual horse-power; horse-power of an engine varies with the conditions; strength of horses; strength of a horse equals two-thirds a horse-power of an engine: variations in power of a horse; power of machines; absurd misrepresentations.

The work done by a steam engine is usually expressed in units of work called "horse-power." This term was invented by James Watt, who defined it as the ability to lift 33,000 pounds one foot each minute or a less number of pounds an equivalent number of feet per minute. In obtaining this unit, the actual work of a large number of horses was measured, from which it was found that the work of the average horse, working 10 hours per day, was equivalent to 22,000 pounds lifted one foot each minute. From this it is seen that the unit adopted for the steam engine is 50 per cent greater than the work of the average horse. This I think is in accordance with experience where steam has been substituted for horses in driving the machinery. I have made many inquiries of some threshers, receiving the inevitable answer that a ten horse-power engine gave very much more power than 10 horses. It is, no doubt, true that many have met with experience very different from this, especially where engines nominally of two or three horse-power have been substituted for the same number of horses. This probably cannot be accounted for except in a general way; but, no doubt, it comes from the fact that either exceptionally strong horses had been used, or that the engine did not develop its nominal horse-power.

The nominal horse-power of an engine is calculated by multiplying the average steam pressure acting on each square inch of the piston, by its area and by the space passed through in feet per minute and dividing that result by 33,000. This, of course, is somewhat greater than the power actually developed, as it makes no allowance for friction and other losses. As the engine becomes smaller these losses become a greater and greater proportion of the work of the engine. The average steam pressure acting on the piston is much less than the boiler pressure. This is due to two facts: first, the steam is expanded to a greater or less degree after it gets into the cylinder, and, second, there is more or less of pressure in conveying the steam from the boiler to the cylinder.

In obtaining the nominal horse-power of small engines, manufacturers usually count on an average pressure of 40 pounds per square inch on the piston. To secure this pressure on the piston a boiler pressure much higher will be needed, depending on the expansion of the steam after it reaches the cylinder and on the losses. When an engine is sold the manufacturers should state clearly what steam pressure should be carried in the boiler to develop the nominal horse-power. The governor which is furnished with the engine should be set so as to give the proper speed. The expansion of the steam in the cylinder is accomplished by closing the port that admits steam before the piston has finished its stroke. In large engines this port is sometimes closed as early as one-eighth of the stroke of the piston; but in small engines, designed to run at high speed, it is closed much later. In very small engines live steam is usually made to follow the piston nearly through its stroke; in this way more power is developed from a smaller engine, although at a slightly greater expense for fuel.



FIGS. 187 AND 188.

Figures 187 and 188 on the diagram will, no doubt, serve to make the foregoing statements clearer. Let the horizontal line represent the stroke of the piston, and suppose it, for convenience, divided into 12 parts. Through each one of these parts draw a vertical line, and make its length proportional to the pressure acting on each square inch of the piston, when in that position. Join the ends of these pressure lines and the result will be a diagram like that shown in Fig. 1 and Fig. 2, in both of which FG represents line of atmospheric or no pressure. The area of these diagrams will represent the work done at each stroke of the piston. The diagram in Fig. 187 represents the case when the steam is admitted only for one-third of the stroke of the piston; that at Fig. 188 is the case in which steam is admitted for three-fourths the stroke. In each diagram the piston is at 1, moving toward 0 when steam is first admitted, and the pressure is nothing. The pressure rises to AB, stopping the piston at 0, and starting it in the reverse direction. These pressure lines remain of the same length until the piston gets at B, at which time the steam port is closed and the pressure falls at the successive positions of the piston, as shown by the shortening of the lines between CD and ED. At C the port opens from the exhaust side and allows the steam to escape, so that the pressure falls to the line ED, which is that of the air in non-condensing engines, if there is no back pressure. The reverse operation takes place on the other side of the piston, and would be represented by a diagram of similar form, but turned the other side to.

The length of the line C D represents the pressure not used, and consequent loss. This is greater in Fig. 188 than in Fig. 187. In very large engines this loss is an important matter, and every means is taken to get all the power possible out of steam. Any derangement of the valve motion affects very materially the form of these diagrams, and consequently the power of the engine. Sometimes a certain amount of steam gets on the wrong side of the piston and opposes its motion, so as to decrease the power very materially. Now, the nominal horse power of an engine can be realized only when the engine is in perfect order and running without friction, as has been shown by the foregoing explanation. The actual horse-power should, however, be greater in case of an engine in good order than the same number of horses of average strength. By running the engine at higher speed than rated, or carrying a higher steam pressure, the actual horse-power developed may be made to exceed the nominal horse-power.

From the fact that the power of an engine varies within such wide limits, and depends on conditions which the maker can have no control of, most reputable makers will give no guarantee of the horse-power of their engine, unless they know every condition under which it is to be worked. They very much prefer to sell an engine of a specified size rather than of a specified power. The nominal horse power of small steam engines is found very nearly by squaring half the diameter of the cylinder. Thus an engine with cylinder six inches in diameter would usually be called a nine horse power engine, sometimes a ten horse-power. When the cylinder is seven inches in diameter we have a twelve horse-power engine. When the cylinder is four inches in diameter, we have a four horse-power engine. This rule is a mere accident, and is true only for small engines with cylinders not exceeding eight inches in diameter. This is true simply because the speed of piston per minute for those engines is usually about 260 feet for assumed average pressure of 40 pounds, or 220 where the average pressure is assumed to be 50 pounds per square inch of piston. With a mean average pressure on the piston of 50 pounds per square inch, the following values of diameter of cylinder and speed of piston in feet per minute will be found:

Nominal Horse Power.	Diameter of Cylinder in Inches.	Piston Speed in Feet per Minute.
1	2	220
2	2¾	230
3	3½	220
4	4	220
6	5	210
9	6	210
10	6⅜	220
12	7	204

The piston speed in feet per minute can always be readily figured when the length of the stroke and the number of revolutions per minute are known. The strength of any particular horse is an uncertain amount, but the strength or power of an average horse may be known within quite narrow limits. I have already mentioned the investigation of James Watt, who found that the strength of an average horse used in pulling was 22,000 pounds raised one foot per minute, or two-thirds of the horse-power of the steam engine. This is supposed to represent the strength of a strong, well-fed horse that can be exerted steadily for ten hours each day.

For shorter periods of time much more strength can be exerted. Trautwein says that the strength is increased as the day's work is shortened, and a horse working but five hours per day can exert twice as much force per hour as one working ten hours per day. There is no question but this latter principle holds true to a certain extent, and in some cases may account for deficiency in power of an engine when compared with the power of horses. Horses can do more work in some positions or when using certain sets of muscles than in other positions. Thus a man can do about 40 per cent more work in a tread-mill when he uses the muscles of both arms and legs than when he uses his arms alone.

Nystrom does not, however, find this to hold true with horses in a tread-mill. We have seen that the horse can do work that is equal to two-thirds or 67 per cent nearly of a horse-power by traction alone. Nystrom says that in a tread-mill, at a speed of three feet per second, a horse can exert 57 per cent of horse-power, and at a speed of nine feet per second, he can exert only 16 per cent of horse-power measured in pounds lifted feet per minute.

It is frequently claimed by salesmen of machinery that by means of their machines more power is developed than is supplied to the machine. This may be made to look reasonable by the specious words of an agent or even by watching the machine itself, when nothing definite is known of the power supplied. This doctrine is, in reality, more preposterous than that of perpetual motion, for it not only assumes that no power is required to run the machine, but that besides, running the machine, it actually does work in addition. It is true that more work may usually be done with a machine than without it, but that is because the power is applied to so much better advantage, as to more than compensate for any loss.

THE SCIENCE OF CLAY-WORKING.

BY PROF. R. C. CARPENTER.

[A Paper read before the Michigan Brick and Tile Association.]

In talking on the above subject, I lay myself open to the charge of speaking about something which does not exist. It is something, however, which should exist, and no doubt the day will come when we shall be able to foretell results as to character and kind of ware with positive and absolute certainty, merely by analysis and examination of the clay.

As is well known, the art of working clay so as to make brick and pottery is the most ancient of arts, at least it dates back long before historic periods.

We neither know the name of individual or of nation who made the first bricks. We find that they were made in the earliest times by nations in all portions of the world. They were made in Egypt, Mexico, Peru, and China ages and ages ago. More than that, it is doubtful if, with all our improvements in civilization and in manufacture generally, we can make brick equal in quality to those made in Assyria and in China three thousand years ago.

The methods used in Egypt were in that day as now, only crude, while we are in total ignorance respecting the methods in other countries. This much we know, however, the brick made in those days was often enameled or covered with porcelain and rivaled our best attempts in clay working. The art of burning, judging from the bricks, was well understood.

The important operation of tempering, which is often entirely omitted in our practice, was considered of so much importance by the ancient Chinese, that the son worked the clay prepared by the father, and he in turn prepared a stock to be worked by his posterity after he should have passed from this life. This, no doubt, would be considered thorough work, but it is much too slow for people of this age and generation. It is not my purpose to talk of the methods of brick-making, but of the philosophy of those methods and as to what improvement is reasonable and can be expected.

The material used for brick and tile making is probably the most abundant in nature; there is scarce a township but what affords clay, inferior though it may be, that will make, when properly worked, brick or tile.

The character of the material is no doubt the most important feature in the manufacture of brick or tile, and common prudence would require that it be well investigated before extensive manufacture be commenced. I have often seen it stated that the only way to tell the quality of clay was by actual trial of the operations of manufacture. This is no doubt true, but the admission of that truth indicates deplorable ignorance on our part. It is a fact that we understand but little about clay.

In 1828 Wöhler discovered the existence of the metal aluminum. This metal possesses properties which render it the most valuable of all metals for commercial use. It is malleable, very strong, a good conductor of electricity, and besides all this it is very light, being only about one-fourth as heavy as iron. It will not corrode, and when once polished will retain its brightness for years. This metal exists in greater abundance than any other metal. Every clay bank is a mine, from which the ore of aluminum can be had in abundance. Pure clay is an ore of aluminum, and consists of about one-half part aluminum and about one-half part silica and other minerals. Yet despite its great abundance, aluminum is still one of our precious metals, its price not admitting of its common use. Every year, however, advances our knowledge respecting this precious metal, and improves the art of extracting it. This improvement has a marked effect on the price, and it is claimed that it soon will be sold as low as ten or fifteen cents per pound. The most successful method of reduction is by the electric furnace, by means of which a heat of five or six thousand degrees can be produced. The largest dynamo in the world is in use by Cowles Bros., at Lockport, N. Y., for the purpose of reducing aluminum ore. At present no successful method is in use, by means of which it can be reduced directly from the clay. The ores from which it is extracted are the chloride and sulphide of aluminum.

A great fortune awaits the inventor who successfully brings out a cheap process of reducing aluminum from the clay. The other ingredient of pure clay, silicon, exists as an oxide called silica, quite pure in certain of our hardest rocks. The compound is silicate of aluminum, with properties essentially different from either of its constituents.

Silicate of aluminum is found nearly pure in China clay. It is, however, always associated and chemically combined with a certain amount of water.

This water cannot be removed by any ordinary process of drying. It may, however, be removed by burning at a temperature of over 1000° F. It is to this water that clay owes its peculiar plastic character. When this water has once been removed by burning, the chemical nature of the silicate of aluminum is so changed that it will never again take water as part of its chemical composition, and consequently never again become a plastic material.

Water may make it crumble or fall in pieces, but it falls in pieces more like a lump of sand than a lump of clay. It is never again sticky or plastic.

Silicate of aluminum or pure clay in burning shrinks to a considerable extent, and if the heat is not perfectly uniform on each side, ware made from it will warp in burning. This fact makes it necessary to add some substance which will counteract the effect of the fire to a greater or less extent, and will also tend to hold the ware in shape. Silica in the shape of sand has been found to answer well for such purpose, and this sand does better service if the particles are sharp, so that when the fire contracts it they will unite together by their sharp sides and not slide or roll one over the other.

Besides these elements there is usually found with clay many impurities, and also combined with it, a greater or less quantity of other minerals. There is almost always lime and iron oxide, and frequently magnesia. The latter substances act as fluxes and in proportion to their quantity make the clay more easy to be vitrified and fused. When they are absent the clay is so little affected by heat that brick made from it will stand well in the hottest furnaces. In fact such brick will stand more heat than any other material, excepting some rare minerals.

So that clay, inversely in proportion to its impurities as far as ordinary means of producing heat is concerned, varies from absolute infusibility to fusibility at a low temperature.

This is about the extent of our scientific knowledge respecting the material of brick making. You see it is exceedingly general and of little practical use in any particular case. We may tell you that a good brick clay may contain one-fifth alumina, three-fifths silica and the remaining one-fifth made up of water, iron, lime, magnesia, etc. Yet it is true that good brick are made when the elements are in quite different proportions, and sometimes even when a large quantity of organic matter, as sawdust or other material is added. This, however, is doubtless removed in the burning.

The following analysis of several clays gives the amount of the various substances entering into the clay:

Kind of Clay.	Locality.	Analyst.	Silica.	Alumina.	Lime.	Magnesia.	Ferric Oxide.	Ferrous Oxide.	Alkaline Bases.	Water.
Common Clay	......	......	49.4	34.3	1.5	5.1	7.7	......	......	2.0
Pipe Clay	......	Brown	53.6	32.0	0.4	......	......	1.3	......	12.7
Fire Clay	......	Tookey	65.1	22.2	0.1	0.2	......	1.9	0.2	11.3
China Clay	Cornville	......	46.3	39.7	0.4	0.5	......	0.3	......	12.8
	Hull	......	39.6	45.0	0.1	3.3	......	......	......	10.0
Best Chinese Porcelain	......	......	71.0	22.5	3.8	......	......	......	2.7	......
Stoneware	Vauxhall	......	74.0	27.0	0.6	0.2	2.0	......	1.06	......
Earthenware	Delft	......	49.0	11.2	18.0	0.8	2.8	......	......	13.09
......	Amboy, N. J.	Weber	46.3	39.7	0.4	0.4	0.3	......	......	12.7
......	Windsor, Ill.	Weber	76.1	15.0	0.6	0.4	1.1	......	1.5	5.2

There is a great field for investigation by scientific men in this line. What ought to be done is this: Brick or tile should first be made with pure clay, then with successive additions of sand, then with additions of the other impurities; finding in each case the heat required to burn the brick, the heat the brick will stand without breaking or fusing, the durability as respects water and frost and finally its strength.

In connection with this I wish to make a proposition to the tile and brick makers. If each one of you will mold and burn for me a number of prisms of your clay four inches long and one inch square, I will test those prisms for strength and durability and let you know the results. If you will burn these in different portions of your kiln these results will be valuable as giving the effects of heat.

Composition of pure clays: Silica, 46.3; alumina, 39.8; water, 13 9. Silica is composed of silicon, 1 part; oxygen, 2 parts. Alumina is composed of aluminum, 2 parts; oxygen, 3 parts.

ARRANGEMENT OF MACHINERY AND KILNS.

This is no doubt a very important matter, and there is probably no business in which it is of greater importance, from the fact that the manufacture of brick or tiles as usually conducted is largely done with hand labor. Any arrangement which can save steps of a laborer will reduce the cost of manufacture.

There is probably no business in which the arrangement of machinery is so dependent on circumstances as in clay working. The probability is that the clay or material will be in such a position, with respect to the conformation of the yard, as to make it impossible to secure the arrangement desired. Again, mistakes are oftentimes made in laying out the work for the various men in the yard. Some positions may require more men and others less than was originally supposed. This fact will make it necessary to make changes or additions in what might otherwise have been a perfect plan.

Again, the clay itself may work very differently from what was expected, with the result to make the buildings and arrangement essentially bad. This will be seen after a few years by changes made in the plant. If costly buildings are put up in the first instance, unsightly additions are soon added.

The theory of perfect arrangement is simple in the extreme and no doubt is fully understood by all. The prime object is to so arrange the machinery as to require the least possible expenditure of force in carrying the clay through the various processes of manufacture, and until stored for the market. This of course requires short distances and no doubling or turning on the track. When engines are used to do the hauling, distances are of less account than sudden bends.

The arrangement of the Fire Clay Works at Jackson, Mich., is a studied one and probably as good as could be devised for the system of manufacture used, in that the predominant or ruling feature of the arrangement is the factory. This is of rectangular form, three stories in height; clay is drawn into one end, the tile are dried in the building and sent out in the other three directions to the various kilns. The other features of the arrangement, while as good as circumstances will admit, are certainly not ideal. The storing yard is not conveniently connected with the kilns.

No doubt more could be said on the method of arranging kilns and plant, but after all, peculiar circumstances in each particular case will prove stronger than principle or theory.

CLAY WORKING MACHINERY.

It has been stated by an eminent member of this association that "despite the intricate and automatic machinery built by many during the past few years, no machine has yet been made capable of making a brick." This is doubtless all true, and yet notwithstanding there is perhaps no industry in which the variety of machines produced has been greater.

If we consider the manufacture of brick or tile to require the following operations, we shall see that but few of these operations are at present done by machinery:

1. Mining.
2. Transporting.
3. Tempering.
4. Grinding.
5. Molding.
6. Transporting green brick or tile.
7. Dumping, turning, haking or equivalent.
8. Transporting dry ware to kiln.
9. Burning.

The principal reason why machinery was not used to a greater extent is that the magnitude of the operations was not sufficiently great to pay interest on costly plants. It is to be noticed that, except in the vicinity of very large cities, this manufacture is carried on in the crudest buildings and with very cheap or very little machinery. Considering the selling value of the products, the investment in machinery is exceedingly small. I have known yards to produce from $6,000 to $10.000 worth of ware annually, where the machinery would be dear at $2,000 (building and kilns not counted).

Even with costly machinery many doubt that much is saved, over the old-fashioned hand methods, where they can be used. It is no doubt true, however, that whether it will pay to use all the improved processes of manufacture or not depends to a great extent on the magnitude of the business.

As an illustration, suppose that by paying out $5,000 you can get a kiln that will save 10 per cent in ware as compared with your present kiln, will it pay to use it? The first inquiry must be as regards the probable sales and your business for the year. Ten per cent interest on $5,000 is $500, and if the kiln will not save that much money it is a poor investment. The same reasoning should be applied to "machinery." Wear and tear and interest must be counted against the machine every time. There is little room to doubt, however, that the use of machinery will constantly increase. Even if machinery will not pay, it is, if well made, reliable, and is worth something for that reason alone.

Of the nine operations of brick and tile making, all are capable of being performed by machinery excepting the tempering and burning and a certain portion of the operation of mining. Transporting may be done by link belt carriers, by belts or by cars. It is my opinion that for transporting the clay, link belt carriers or belts afford the most satisfaction. They are cheap and they can be extended to any distance and may even be made to change direction. The transportation of the green brick from the machine without injury, to any point where it may be dried, is not so easily solved. Yet, no doubt it may be done; the fact that the places where brick is wanted for drying are continually changing may make it necessary to use cars, which may be shifted from track to track. The transportation and placing in the kiln can perhaps never be done without human agency and human supervision.

We will consider a few processes in detail, first, the "*moulding*:"

The machine for this process is usually combined with the mill for grinding the clay. In the manufacture of these machines our own State has taken an honorable position and some of the most successful machines have been originated here.

The machines for making brick or tile, although almost infinite in number, can still be reduced to a few general classes.

CLASSIFICATION OF MODERN BRICK MACHINES.

Knight classifies the brick machines as follows:

Class I.—Those in which a slab of clay exudes from the brick mill and is cut into lengths which form brick. The cutter is a wire or knife and either travels with the slab while cutting or moves in an oblique path—or in case of intermittent action of clay remains at rest. This class will include nearly all our tile machines and a large portion of our brick machines.

We will make two subdivisions of this class in accordance with mechanism used:

Subdivision 1st.—Plunger machines.

In these machines clay is forced out from the bottom of the pug mill by a cam of some sort or by a piston.

The Penfield Machine, Chandler & Taylor, and many others are illustrations of this class of machine.

Subdivision 2nd—The Auger Machines—In which the clay is ground and pressed through the dies by steel or iron knives arranged spirally. This machine should be of especial interest to us, as it no doubt was invented by an honored resident of this State and a member of this society. More than that, its principal improvements have been made by residents of Michigan and its construction is more extensively carried on in this State than in any other. For the manufacture of drain tile this machine is unrivalled. It gives a steady stream of tile, thus insuring a steady strain on all the working parts. The liability to break out cogs, due to the intermittent action, is very great in the plunger machines. This machine is better in that respect. So far as tile making is concerned, this machine has a motion peculiarly fitted to fill the die and make a sound and strong tile.

The auger machine is said to be inferior to the plunger machine for making brick from the fact that the rotary motion of the feed mechanism is not so well adapted to filling the square corners of the brick die.

In the practical and actual use of these two machines this objection is no doubt a valid one, but from some observations I have made of the workings of various brick yards I have come to the conclusion that although this difference does exist, it exists simply because the auger machine is not handled with the same care as the plunger machine.

It is the custom, and it is a pernicious one too, of digging the clay from the bank and of running it through the brick machine as dry as it possibly can be worked. The result is, that you have bricks in shape at least, but if you examine the structure of such a brick you will find it composed of twisted wads of clay, stratified in concentric layers and anything but homogeneous in structure. Such a brick when exposed to the weather soaks water irregularly, and there is often actual spalling or shelling from the action of moisture alone.

From the fact of continuous working the auger machine will work clay much drier than the plunger machine. It will work clay when very stiff, just how stiff I do not know, but it will work clay very much stiffer than the plunger machine—probably with one-half as much water. I have seen an auger machine work clay easily while the same clay put in a plunger machine caused the breaking off of fifteen ¾-inch bolts which held the die in place.

This peculiar capacity of the auger machine has led to its abuse. It has made poor ware it is true, but could any machine have done better, with the stuff that was fed into it. Now there is no doubt that a good deal depends on the machine, but there is more depending on the tempering of the clay.

Among the manufacturers of this kind of machine I may mention Kells & Son, Tiffany, Adrian Machine Co., Michigan Tile Machine, Smith at Jackson and Brewer at Tecumseh.

Class II.—Includes those machines in which the clay passes from the pug mill into molds, in which it is sometimes pressed and from which the molded brick is discharged.

There are several varieties of these machines, any or all of which have points in their favor:

Subdivision 1st—Soft mud machines.

Clay is tempered as for hand working and fed into molds, same as used in hand working. These molds are carried to yard and spread for drying. There are several kinds of these machines.

Subdivision 2d—Those in which we have a vertical pug mill, underneath which a large horizontal wheel moves, centered on another point. This machine carries on its face a series of molds with adjustable bottoms, which pass during a part of the revolution under the pug mill, after which the bottom rises and lifts the brick out of the mold. This principle is used in an old English machine, but is well known to us in the Sword's Brick Machine, made at Adrian.

Subdivision 3d—Have the molds in a vertical wheel, which is fed by either a vertical or horizontal screw.

Subdivision 4th—Have two vertical wheels on both of which are molds, the part between the molds in one pressing the clay in the other.

Subdivision 5th—In this the molds are linked together by an endless chain running over two sprocket wheels.

Subdivision 6th—In this the clay is pressed by a reciprocating piston.

Subdivision 7th—In this the molds are worked back and forth beneath the pug mill.

GENERAL REMARKS.

There is little doubt but that the practice is a good one of making some portion of the machine so weak that it will give away when an extraordinarily heavy strain comes on it. This part ought to be one that may be easily replaced.

This practice, I am aware, is not followed by many makers, and perhaps it is to their profit not to do so. One heavy machine, and, in many respects, a good one, seems to have the weak point in the cogs of the main driving wheel. No doubt every machine has one part peculiarly apt to give way. If that part is one not easily and readily replaced, that machine is certainly a faulty one.

It may seem strange to coolly advise the construction of a machine in this way, instead of trying to made everything equally strong.

A brick or tile machine made like the "Deacon's one horse shay" would, in my opinion, be a faulty one, for should it be overstrained, it would fly in pieces and become an irreparable ruin. And it would probably go in clay working much sooner than the famous "shay."

I have spoken of making one portion, and that a part readily replaced, weaker than the rest in order to save a costly break down. Modern machine engineers have found a process much neater in most respects and one not requiring anything to break, in case of an overstrain, viz. a friction clutch or its equivalent. The theory of its action is simply that the parts of the clutch will slip over each other whenever the dangerous limit of strength is approached. I am sorry to say that the friction clutch is not always a safe or reliable fixture; it will often hang when it should let go and will sometimes let go when it should stick. I am not sure that it would be worth anything in the mud and dust that surround the brick machine.

THE TILE KILN.

While I have had some experience in burning with certain forms of kilns, I do not feel confidence to advise in regard to detailed methods of burning. I have, however, some well fixed opinions regarding the various classes of kilns and of the economy attending their operation. I entertain the fixed opinion that method can not be described in detail by any one, except for a certain clay in a certain condition. An experienced burner can no doubt handle with success new clays, simply because he can judge by their physical condition about what course to pursue, and then by watching closely he can govern his mode of procedure with the development of the burning process.

The following essential points must be given consideration:

In setting in the kiln, spaces should be left so as to allow an equal draft on all sides of each piece of ware, and so far as possible the pieces should be placed so as to receive an equal amount of heat. The setting should be such that any contraction or expansion due to the burning shall not settle parts of the kiln in such a way as to clog the draft. In setting also no undue weight should be put in any place on the green ware.

THE PROCESS OF BURNING.

This process in reality consists of two very different operations; the first is drying, or what is commonly called "watersmoking," in which the ordinary moisture is driven off.

This process must be conducted with much care for this reason: If we examine the condition of the green ware we shall find that even when it is apparently dry, it still contains a great deal of water; yet there is a great difference in this respect as to how the ware is dried. If the ware is dried by steam heat the moisture may be very small in quantity. If we suddenly heat this ware the water is converted into steam; now steam occupies 1,700 times more volume than water, the result is a minute explosion which tends to disintegrate the particles of the brick or tile, and besides sends a huge volume of steam with much velocity on the parts of the kiln not yet heated. This steam condenses on and tends to disintegrate all the ware in its path. To drive this water from the kiln requires a heat throughout of more than 212° F., and it is an operation which cannot be hurried, except at the expense of quality in the ware. In my opinion it is economy to do this drying largely before the ware is put in the kiln.

The second operation, or the burning proper, consists in driving off the hygroscopic water, or water chemically combined with the clay. This requires a heat of over 1000° F. When this water is once driven off the material of which the brick is made can never be soaked up so as to become plastic. Yet if the operation be stopped at this point we shall not have a hard burned brick or hard burned tile. It is necessary to go further still, and to partially fuse, at least in an exceedingly small degree, the particles which compose the brick. If the heat is too great the particles are all fused and the brick becomes vitrious and misshappen. Just how much heat is needed for these operations is not known, and no doubt largely depends on the impurities in the clay,—iron oxide, sand and lime all making the brick more easy to burn. In the ordinary open top kiln, the heat is often sufficient in the arches to melt cast iron, while on top it rarely rises to more than sufficient to drive off the hygroscopic water, say 1000° F. In this case we will say the range of temperature is from 2500° to 1000° F., although there is nothing certain in that assumption.

This sketch of the operations of burning calls to mind an important precaution, and that is with respect to the admission of cold air. While the ware is very hot, the effect of cold is to suddenly contract it; this result is almost certain to break and crumble the ware. This fact renders it very necessary to take precautions to prevent the admission of cold air after the kiln is much heated.

The addition of sub-arches outside a kiln is a device of much value in preventing the admission of cold air into the kiln. It supplies the kiln with hot air instead of cold air.

The kilns in common use are of three kinds: the open-top kiln, or in reference to the draft, the up-draft kiln; the closed-top or down-draft kiln and a kiln in which the direction of draft may be changed at pleasure.

THE UP-DRAFT KILN.

This is the old form of kiln. For brick burning the walls are usually temporary and put up and taken down with the kiln; for tile burning the walls are usually erected to stay and are made thick. The only top to this kiln is the platting laid on top of the brick or tile after they are in place. It is, however, unnecessary to say anything about the construction of this form of kiln; it is well understood.

The rising temperature tends to increase the draft through this kiln from the bottom to the top, and also as the heat is not uniform but is largely apsorbed in passing through the kiln, the draft will vary in different places, thus increasing the difficulty of managing it and making it absolutely impossible to secure an even temperature throughout. Thus, for instance, if one part becomes much hotter than the surrounding parts, the draft becomes in that place correspondingly greater. The result is a tendency to draw the whole heat of the kiln to that point. This may go on to such an extent as to actually produce a down draft in other portions of the kiln, in order to replace the air carried out in the hottest place. Such things are well understood by practical burners and they know well what to do. They will stop either the rush of hot air upward or that of the cold air downard by covering the top of the kiln with earth at those points.

Again it is extremely difficult to get the heat to distribute itself evenly with such a kiln. The only way it can be approximately accomplished is by preventing the ingress of all possible air from below or from the sides, making the combustion as slow as possible.

At the best this is a wasteful method so far as fuel is concerned. The heat given off from the top of the kiln is a great proportion of the whole, and this is to a great extent wasted. It would be wholly wasted were it not for the fact that a certain proportion must be used to secure draft.

THE DOWN DRAFT KILN.

This kiln is necessarily much more costly than the up-draft kiln, involving as it does, a closed kiln, with passages from the fire to the top of the kiln, a perforated floor so arranged as to allow uniform passage of air, flues beneath the floor and finally chimneys of height sufficient to give proper draft.

This kiln possesses many advantages over the preceding one. In the first place we have the heated air from the fire, received at the top of the dome and gradually replacing and driving downward the colder air of the kiln.

If there is no radiation from the top or the sides of the kiln, the heat at the bottom will in time be practically the same as that at the top. If the draft is uniform in all portions of the kiln, the tile must of necessity be equally burned and we have in that case the theoretically perfect kiln.

As a matter of fact, however, there is radiation from the dome of the kiln, and consequently the temperature is greater at the top than at the bottom; again there is likely to be trouble to secure the uniform draft because the part nearest the chimney is most affected. By placing the chimney some distance off the even draft is secured with les rouble.

THE UP AND DOWN DRAFT KILN.

This kiln has a strong reason for its existence—the term being applied to a kiln that is used for a certain time during each burning as a down-draft kiln, and the burning is finished as an up-draft kiln. This ought theoretically to be the most economical of the kilns mentioned. Since, as we have seen, the principal waste must come in both kinds of kiln in burning that ware which is farthest from the fire, and the greatest difficulty comes in burning the farthest ware without injuring that near the fire.

This difficulty is many times greater in the open-top up-draft than in the down-draft kiln.

A kiln which furnishes the burning by applying the heat where it is most needed certainly has strong arguments in favor of its principle of action.

THE KIND OF FARMING THAT PAYS BEST.

BY HON. GEO. A. SMITH, OF SOMERSET.

[Read at the Hanover Institute, February 7, 1887.]

This question embraces so great a variety of conditions that it can be treated only in the abstract.

We will take the compensation of the farmer in a broader view than to be measured by dollars and cents. There is a kind of farming that accumulates, but the result to the farmer (and his family if he has one) is a poverty that cannot be estimated. Thus we read that Abraham was very rich in cattle, in silver and gold, while Lot had flocks and herds and tents, and their united stock increased to such a number that the country could not support them; here we find in the history of these two men an illustration of that kind of farming that pays best. The one with a life fully rounded out, improving opportunities, an example and blessing to his neighbors and future generations, the other successful in business, but mingling with a wicked people his life became a failure.

The strong incentive to enterprise in every industry is to excel and accumulate property, and to deny that privilege to the American farmer reduces him to the condition of the serfs and peasantry of European countries.

If the farmer cannot have something higher and nobler to look forward to than bare existence, then the vaunted independence of his calling ceases, and he becomes only a grade above the domestic animals he cares for.

Fortunate is that man who has brain to direct, and physical strength to endure the labors of farming; he has a double element of success in his calling and there may be no limit to his legitimate and rightful acquirements.

With scarcely an exception no place in the United States is better calculated for the full development of the agriculturist in the different branches of his industry than Southern Michigan. With a soil easily understood, susceptible of the highest cultivation and conveniently accessible to markets it should not be the exception but the rule that farming paid in the fullest and broadest sense. It does, but how? We have small farms and large ones, small farms that pay and large ones that do not, large farms that pay and small ones that get poorer year by year. The observer has but to look around and all over our State he will see beautiful homes with pleasant surroundings on both large and small farms, with every indication that farming has paid.

The good farmer is careful of his surroundings. His fences and buildings are in good order, his farm implements and tools are well cared for, he knows intimately how his affairs are, how he is placed financially with the world and what he has to expect for the coming year. He keeps a watchful care of his animals, thinning out and disposing of the ones that are depreciating or cannot be made profitable to keep, encouraging the others by good care and attention that he may make the most possible of them. He avoids extremes in any one branch of his farming when failure or disappointment in his expectations would be disastrous. His outgoes are kept within the limit of his income, he has a care for the interest of the State, he is careful to fulfill his obligations to society and looks to the best interests of his neighborhood. He eschews all evil, patent right and Bohemian oat swindles, and does not lie awake nights thinking how he can get something for nothing. In fact his life is rounded out to the fullest possible limit of his surroundings and opportunities.

It becomes us to exalt and dignify our calling, looking well to every means and interest calculated to promote the peace, happiness and prosperity of a great people.

Mr. Willis, of Moscow: In my judgment that farming pays best which most increases the fertility of the farm. I believe that as a specialty the raising of horses would pay as well as any other.

Mr. Wetmore: We are too much inclined to get into ruts and keep in them. It may cost a little to get out but it will be a gain in the end. To give an experience: How many of us raise our own Timothy seed? Two years ago I sowed an acre or two of Timothy seed and after cutting it mowed the stubble. It was about five inches long. In winter I filled one end of the sheep rack with that stubble and the other end with clover hay, and the sheep ate the stubble in preference to the clover, and so did the cows and horses. I got four bushels of seed worth three dollars per bushel, making $12 per acre. Since then I have raised Timothy seed every year.

Chemistry says as to why stock like the Timothy stubble, that plants develop sugar and starch while the seed is forming. This stubble is not juicy—it is dry, but it is good. Timothy that will give one and one-half tons per acre will give eight bushels of seed per acre, worth $24, and one ton of stubble hay, and that hay I save for my stock to do their spring work on. So of clover seed. To get it we must cut the first crop in June. It will not seed if you leave it uncut till July. Why not?

Voice: Not enough bumblebees.

Mr. Willis: Exactly. So save the bumblebees; don't kill a single nest. I prefer large clover because it comes just in time for the bumblebees. I feed large clover till about 10th of June, and when it seeds get three to five bushels clover seed, and then get six weeks' pasture afterwards. It is much better than wheat.

Mr. Armstrong: As to raising Timothy seed, I wish to warn you. In the Genesee valley Timothy was their main crop, and they got two to three bushels per acre. Their flats were flooded each year, and fertilized with the richness of the uplands, and yet this process could not be kept up, but gradually, yes rapidly, impoverished their land. They tried clover and plaster—the larger clover. They found it a good subsoiler, and with an abundant supply of plaster they succeeded in restoring and steadily increasing the yield of their lands. I knew of one man there who cut 3,000 bushels of wheat from 60 acres on a farm from which his predecessor had been starved off.

Mr. Peabody: Debt is the great difficulty in the way of profitable farming. I think in Pulaski and Hanover there is no farmer but that succeeds if he is free from debt.

Voice: That's so.

Mr. Peabody: I think the curse of the farmer is making too much of the dollar and cent view of his business. They sacrifice body and soul and happiness to it. That kind of farming does not pay. A farm does not pay where the owner has 500 acres, but not a picture on the wall of his house.

Mr. Goldsmith: In farming we must do business on business principles. What would you think of a merchant who, when you ask his prices, should say, "Well—I don't know." What busines has the farmer to raise an animal and have no knowledge as to what it is worth? Let him take his papers and know the markets and sell according to demand. If demand is great, a high price will result. If light, the high price cannot be had. What business has a farmer to have hundreds of dollars' worth of his machinery out doors to go to ruin?

Mr. Geo. A. Smith: Farmers, like others, are creatures of circumstances. The man who makes a yard of cloth has mighty little to say as to what he is going to get for it, and reading the papers won't fix it. The most intelligent of you can't tell what wheat will be worth two weeks from now. What we want is to take a broader view of life. We are not independent, there is no such person as an independent man. A farmer may refuse to take less than $1 for his wheat, but that does not make him independent, and when he wants to sell he must take what he can get.

Mr. W. J. G. Dean: As to clover large or small, a farmer of my acquaintance had a ten acre field of Timothy and small clover, and beyond it eleven acres of larger clover, and he said that his stock passed right through the first field and left it to get the large clover. In winter in barn he had clear Timothy, Timothy and small clover, and large clover in three separate places, and his stock when turned free always chose the latter.

Mr. Wolcott: I have tried large clover and when it is alone my stock will trim all the fence edges and take marsh grass, and leave the big clover untouched.

Mr. Wetmore: I sowed big clover and it got so high it disgusted me. The next year I pastured it. The season was very dry. June 10th, I turned the stock off to save the big clover for hay. I saved it till well ripened and found my stock all preferred it to June clover hay.

Mr. G. A. Smith: I find cattle eat clover best when in blow. At any other time cattle will only eat clover after cleaning up the fence rows, etc. I presume Mr. Willis cut his large clover in the blow.

HOW TO MAKE FARM LIFE ATTRACTIVE.

BY HON. THOMAS MARS, OF BERRIEN CENTER.

[Read at the Three Oaks Institute, Feby. 11, 1887.]

Fellow Citizens:

We are prone to make farm life detestable. At every change of weather we are ready to complain; seasons are not right, crops are poor, prices are low, moneyed corporations have combined to rob the poor farmer, and a long catalogue of complaints are heralded from every cross roads, hotel, store, postoffice and social gathering in the broad land, until it has become a second nature for the farmer to complain. His children listen to his complaints, and as soon as they arrive at the proper age to choose for themselves, naturally seek other avenues of activity. This is all wrong; and we ought to face about, and stand on our dignity, be ever ready to vindicate our vocation and uphold it as inferior to none, and thus we shall do much to enhance the attractions of farm life.

Webster never uttered a more forcible and important truism than when he said: "All national wealth depends upon an enlightened agriculture;" a truism illustrated in the history of every nation on the globe, prosperity and wealth ever being found proportionate to a nation's advancement in agricultural knowledge and practice.

This will always be true of any country and it is equally true that the neglect of agricultural interests and the depreciation of agriculture is an index of the demoralization and decay of a nation.

Farmers as a class are moral and law abiding citizens, and the embodiment of those principles that constitute the very foundation and framework of good society.

It is true that character makes the man and not his occupation or surroundings, and that a truly honest man will prove himself such in whatever situation he may be placed; also, that a man lacking these qualities will not be changed by merely engaging in the most honorable and ennobling occupations. Still it cannot be denied that the associations and influences connected with the employment of the hands and brain do have a powerful influence in forming the character of an individual. Farming presents one of the most extensive fields of varied research and close investigation of any of the various occupations of men, and yet how few comparatively that are engaged in it realize the opportunity for mental and physical development which their employment affords? As a class, however, farmers are becoming better educated, and thus better fitted for successful achievement.

There is no reason why the farmer should not be specially educated for his business, and farming rank among the learned professions. Scientific farming requires a knowledge of a greater variety of things than almost any other kind of business. As far as the nature and treatment of soils are concerned, some knowledge of mineralogy is very essential, and a knowledge of chemistry, botany, and entomology are all valuable as far as they apply to the growing of crops and their preservation from the ravages of insects.

The farmer must also be a manufacturer as far as the making of butter and cheese and the curing of hay or preserving of ensilage and crops generally are concerned; while a thorough understanding of the habits, necessities, diseases, etc., of domestic animals is indispensable to success in the work. Surely the farmer, in order to be well fitted for his work, must not only possess a natural taste and aptitude for it, but should receive special instruction in these several departments. In other words, he should be educated for his business, thereby increasing his usefulness and making farm life more attractive.

Our agricultural colleges are supplying this need to a certain extent, but we should have more of them; and our public schools practically ignore in their system of instruction everything pertaining to this important branch of national industry. A great improvement upon the present system would be instituted by inculcating a more general knowledge of those sciences which are more intimately connected with it. The large number of schools in various portions of Europe in which practical instruction is given in farming in all of its various branches have done much in bringing the agriculture of those sections to the high standard it has attained.

We believe no one would think of disputing the fact that a given area of land, with similar conditions, will produce more now than twenty or fifty years ago. This is due to advanced methods of farming, the use of improved agricultural implements, etc., which cause the soil to produce with less expense of time and labor, and hence make farming more profitable now than formerly, so that the farmer of to-day need not make his business the drudgery it was formerly, or, if he works as hard, he can have better returns for his labor in the form of more of the necessities and luxuries of life. Consequently, farmers as a class are not compelled to practice as much self-denial in order to attain success as in the olden time, and this increases the attractions of farm life.

Now, fellow citizens, I might occupy hours pointing out to you the attractions that already exist in farm life, but enough has been said to show conclusively that the occupation has more charms than any other in existence.

Much might be done to increase these attractions. Many farmers lack pride, I am sorry to say a large majority do; a more liberal expenditure of time and money in beautifying the home and its surroundings would add much to our attractions. We neglect our public highways sadly. Suppose we expended the amount of time and money that the residents of our towns and cities do, what would be the result? There is no reason why there should not be as much pride and expenditure of money on our public highways as on the streets of our cities and villages. Many homes all over this broad land are sadly neglected, that, with a proper spirit of pride, might be made attractive. Every farm home should have a flower garden tastefully arranged, and therein attractive flowering shrubs and plants. Give to your wives and daughters all the ground they want for flowers and help them to prepare it and yourself do all the hard work, and I assure you that many attractions will be added to the home. No farmer can have an attractive home unless he devotes a portion of his time to ornamentation in and around his house.

See to it that the street in front of the farm is nicely graded, all rubbish removed, the grass mowed and fences kept up, or, what is better, a nice hedge fence neatly trimmed on either side of the highway. Be sure to remove every species of rubbish around the house and barn lot, do not allow any old boards to remain on the ground to decay and create disease. If you have wooden walks remove them as soon as possible, and grade up with mother earth in a tasteful way, thereby saving much suffering from disease and expensive doctor bills.

People now more than ever before realize that in union there is strength. Men of every walk of life, artisans of every trade, combine among themselves to secure greater power to promote those interests which they hold in common. He who would hold his own in the race of life must join the ranks. Farmers were the last to learn the lessons of the hour, and many of them do not yet appreciate the situation. Those who do not avail themselves of every legitimate advantage to promote their own welfare are sadly lacking in common worldly wisdom. A Grange properly conducted is one of those advantages. Now what does the farmer want that he cannot obtain as well without as within the Grange? It is not legislation. The laws of trade have stood for a thousand years, are stronger than statutes and are broad enough to cover all his needs. When the farmers are strong enough to compel the execution of statutes they will be strong enough to enforce all just demands without the aid of special laws. On the other hand there is nothing which tends to promote the farmer's individual welfare and extend his influence among his fellowmen that cannot better be obtained with their assistance than without it. The aid that a man receives from a well disciplined society is as much more effective than that which he receives from the world at large, as a trained army is more effective than a mob. You may think that this is deviating from the subject, but I cannot close this paper without alluding to this medium of attraction to the farmer's life.

DISCUSSION.

Mr. Warren: I want to emphasize the opportunity for wider culture on the farm than in business. I know that even men of large business are very apt to be confined to one particular groove and mentally dwarfed in consequence. The farmer has a broader field and can be as broad minded as he pleases.

President Willits: That is the reason why the farmers' boys are the successful ones in general business life. On Wall street, and everywhere in the active walks of life, you find that the head man grew up on the farm. So in Congress. It is the man who had a general business, either as a lawyer or otherwise, who has the most comprehensive mind and the readiest grasp on the multiple variety of subjects that come up for consideration. For that reason the country lawyer who is called upon to deal with a great variety of cases is apt to become more generally useful in Congress than the more specialized lawyer from the cities. I believe in a man standing by his cloth, and don't believe in this constant complaining of farmers. The successful man must be an enthusiast in his occupation, be it medicine or manufacturing or farming. Talk that way and believe in your business and the boys will not want to leave the farm.

Senator Sherwood, of Watervliet: I disagree with the idea that farmers ought not to complain. I think that when we find things wrong it is our business to complain, and to insist on the rectification of things that can be rectified. Moreover, I don't quite believe in so representing our business as to attempt to crowd everybody into it. The manufacturers and merchants and lawyers don't do this.

Prof. Cook: I visited a friend's farm where for half a mile along the roadside he used the lawn mower. Now, we cannot all do that, but we can clean out the rag weed, and clean up the fence corners, and make things attractive.

Senator Mars: I take pride in my roadside. I pick up every stone and mow it often enough not to need to rake up the grass.

Mr. Wm. Chamberlain: I tried my mowing machine along the roadside and the sickles looked like it afterwards. I like to have other people mow down their weeds and briers. We are very fond of looking to the law or some outside power to help us, but it is the farmer who attends to his own business and takes care of his own farm who succeeds. This is of more importance than the Interstate Commerce bill, or all the laws that can be passed.

Mr. Miller: I want to tell how my father kept his boy on the farm. When 16 I detested it most heartily and just about then my father said, it is about time for you to go to the Agricultural College. There I found that farming could be made attractive and desirable, and that it depends on one's self to make it so. Ever since I have thought that the farm was just the place for me.

HOW TO AMUSE THE YOUNG PEOPLE OF THE FARMS.

BY MRS. MARTHA W. SCOTT.

[Read at the Fremont Institute, February 4, 1887.]

Mr. Chairman, Ladies and Gentlemen:

The subject assigned me is a problem with several unknown quantities, and seems to be hard of solution. This subject includes also the graver ones, how shall we keep them on the farm? and, what instruction shall they receive? and it is impossible to discuss the subject profitably except in this connection.

In the first place the mature mind is not altogether satisfied with the conditions of life, and in many places the farms are being annexed to large holdings and turned over to tenants. Evidently we must improve upon the conditions of farm life, making it pleasant and profitable, if we expect the young to be satisfied with it.

The desire, on the part of the children, to leave the farm is not the result of viciousness, it is not because the young are unwilling to labor, or are less enduring than their parents, but because they dimly see the great possibility in life, and having outgrown the old ways, they are looking for something better. They are seeking a higher standard of intelligence, a nobler manhood and womanhood, and it will be impossible to make them happy and contented unless we widen the possibilities of rural life.

The great want, and among the first things to be provided to amuse and instruct the young, are books. Judiciously selected books will make the leisure time pass pleasantly and profitably, and as the mind becomes stored with useful knowledge, a vast amount of nonsense will be crowded out. Reading circles should be established in every neighborhood, and all books read be thoroughly studied and discussed.

On many large farms, where the buildings cost thousands of dollars, where the cattle are numbered by the score, and the granaries are overflowing, the children's rights are overlooked, and the home is without books. This is wrong. The young people upon farms need books far more than those who live in towns and cities. They cannot have as many chances for improvement by coming in contact with the world's great men and minds. They have fewer opportunities for hearing learned lecturers and eloquent speakers, therefore it will be well to give them a thorough course of reading.

So in seeking to amuse the young, don't forget the books. The hardest persons to amuse, and the children most annoying to parents, are those who never read. Try to have the children acquire a taste for reading, because when poor health and old age come, when they are past active pursuits, this is an unfailing pleasure. In the arts and sciences, in inventions, modes of tilling the soil, and manner of living, and in everything which increases the sum of human happiness, this age is rapidly advancing.

Now, while the young are eager to march with the advance guard, we shall make an irreparable mistake if we lag grumblingly in the rear. We should walk side by side with them, making farm life pleasant, intellectual and worth living. The country school should be made as good as the town school, with a graded school for advanced scholars in every township. If this were placed in the center of the township every child in the country could have the benefit of these and still be restrained by home influences, at an age when they are most apt to fall a prey to alluring vices.

Such schools would bind communities together, elevate society, and give the young more amusements and social pleasures. Knowledge is the great fascinator, the foundation of true happiness and amusements. Thus, if we give the young a chance to become acquainted with the world and its great minds it will be comparatively easy to amuse them.

In the rush and hurry of the present age, doubtless some of the young people expect to jump into place and position, without first taking the "regular course." Now the first item in the regular course to success is labor. Mental or manual labor must go before every achievement.

Every invention which lightens toil and increases the power of mind over matter was first conceived in the brain by hard mental labor. The productiveness of Michigan, its agricultural wealth and educational prestige are the result of efforts made by thinkers and toilers. While we teach that all labor is honorable, let us remember that the best work, either mental or manual, must have dashes of leisure and pleasure between times. To lighten labor for the young we must have rest, recreation and amusement. To work all of the time is to dishonor manhood, and change the image of God in man to the semblance of a beast of burden. However, we want less manual and more mental labor, less hand and more brain work, less moqn and more book farming, and the results will be more satisfying.

We are not social enough, but I think we are improving. Boating and hunting, picnics and excursions, festivals and fairs, commence now with mosquitoes and end with frost. Let the young people take them in, they are harmless, and remember that what interests the children should not be beneath the notice of parents.

Excursions which cost one dollar will take one half across the State, and while they please, they also instruct and furnish food for thought. Don't spend ten dollars on a month old pig, and refuse your boy one for an excursion. His heart is as much set on amusement as yours is upon Poland-China pigs. Don't comb, curry, house and grain your colts, and, metaphorically speaking, turn your boys out to grass. Don't give the boys the poorest quarters in the house, and save the furnished rooms for transients. Don't make your home so chill that they find it jollier at the saloons.

Have games, jokes and stories at home, as good as can be found elsewhere. Have parties, temperance lectures and spelling schools.

The latter will improve quite a number of old people. Have the girls learn music with bread making. When you plow for vegetables spade up the flower beds and spread compost on them. Interest the children in planting trees upon anniversaries. Have lawns and shade, flowers and fruit, birds and music, boating, riding and driving, and if you keep out of debt, a little paradise can be made, even on a farm.

It was thought, when the serf wore his master's collar, and so on down the ages, that the agricultural toiler only lived to benefit the rest of mankind.

Times are changing, the standard of intelligence is being elevated, the world's great thinkers are looking, and helping, and expecting that the agricultural toilers will take another upward step. And they are climbing the upward grade intellectually, socially and politically. Having learned to work unitedly, the power for good which they thus hold can hardly be measured, and as yet is not fully appreciated. Agricultural colleges, experiment stations, fish hatcheries, farmers' clubs and granges are all working together for intellectual and financial prosperity. The world worships that which pays and applauds success, and by united efforts we mean to win success, to make our labor pay and to cause the enactment of just laws regulating the distribution of the proceeds of labor. To have leisure and pleasure for ourselves and children we must make the farms pay better. To make them pay better we must cultivate them better.

To man is given dominion over the earth, he is lord of animate and inanimate creation. The seen and unseen forces are waiting to obey him. Yet without cultivation the earth is little better than a barren waste. Every noxious weed is evidence that we have not obeyed the injunction, "Subdue the earth," and every waste place denies our right to the soil.

So man without culture is a savage and the mind of man a gem upon which the light plays fitfully, alternating with darkness. We have minds capable of searching into the mysteries of Nature, or soaring among the stars, and in in some degree of annihilating time and space. Then let us unite hand and brain work, and thought and culture will assist us to rightly cultivate the soil. To the trained hand and the cultivated mind must we look for help to lift that burden which falls heaviest upon the mothers and children. Sometimes when we are utterly wearied with the same round of cares, the same scenes from day to day, we look back to the times of the shepherds and patriarchs, and think they must have enjoyed life, wandering from place to place with their flocks and herds to find pasture. Standing by the side of Abraham and looking over the little encampment upon the borders of Palestine, how happy Sara must have been, when she could say "To-morrow we shall strike our tents," "To-morrow we shall move on among new scenes," "To-morrow we shall camp on green slopes, beside unfailing waters." But it is not to the past we should look, with its old ways and traditions, neither should we be satisfied with the present, but we should make progress toward a prosperous future. When we look out and see the industrial colleges opening wide their doors to the boys and girls from the farm and workshop, and to the children of every industry, then we know that we have lived generations too soon. When we contemplate the great advancement of the past fifty years, the efforts made by thinkers and toilers, we can dimly see what the twentieth century will usher in.

And now, fellow laborers, by the help of our Agricultural College, by united efforts, and by Grange movement let us seek to elevate the standard of intelligence among all the industrial classes, making the homes brighter, the burdens lighter and the self-respect greater among the toiling millions, and in this good work may Michigan lead the States.

INDUSTRIAL TRAINING FOR BOYS AND GIRLS.

BY DR. MARY E. GREEN.

[Read at the Charlotte Institute, February 16, 1887.]

We know we must submit to laws we do not make, to taxes we do not impose, to justice we cannot administer. As mothers, wives and daughters we may develop all the best faculties of men, but we are not citizens. I believe the time is coming when man shall be so grand and just under woman's education and influence, that neither will longer complain of injustice. Slavery always makes slaves of two; the one who holds the chains and the one who wears them.

But in thought at least we are free, and with the equal advantage of education, with the knowledge that we have a voice in the education of our children, ought we not to hope that great things may be accomplished?

If women would think and then act, we should at once have a more practical education for our children. By practical, I mean an education in those things that will tend toward giving one ideas whereby he can earn a living.

What are some of our schools now? Places where the cramming process begins early and continues without intermission, through school life, with no thought or attention to any physical development. 'Tis no wonder that the end of school life finds so many enervated young men and women. We hear of innumerable wonderfully bright boys and girls, but how many of them become exceptionally bright men and women. Somewhere they have been stranded. I would that our public schools taught practical things. That school or education is a failure that leaves a person, at the end of school life, in a condition unfitted to maintain himself.

Theoretically, our public schools are for the poor. We say education is necessary to prevent pauperism; to prepare the poor to become useful citizens; we must have men and women who are to be self-supporting. But practically, our high schools are for the rich. They are maintained at an enormous expense; let us see in what respect they benefit the poor. The washerwoman's and the day laborer's homes are taxed equally with those of the banker's and merchant's, to maintain a higher education which is simply a luxury, or to gratify a peculiar taste which only persons of leisure and wealth can indulge in, for it is an undeniable fact that the vast majority of the poorer class of children are obliged to leave the school to maintain themselves or help in the support of others, before reaching the higher grades.

Of what practical use is Latin, German, speculative astronomy, the name and reign of the Cæsars, if the actual necessities of life are to be earned by days and years of manual labor?

Of what use to a girl of fifteen years who must needs earn her living, is this example: "At thirty cents a square yard, what will be the cost of plastering a cubical cistern which contains three hundred barrels?"

I think you will agree with me in saying that for the class of people for whom the public schools were established, a school should teach household economy, the chemistry of cooking, how to cut and make garments and needlework. Such knowledge, combined with her books, would be a revelation to a girl's life hitherto unknown.

Two years ago I visited one of these industrial schools in Philadelphia. The girls were making garments. The boys were designing, doing metal work, wood-carving and using various tools in quite an astonishing manner. The school was maintained the same as the public school, being, in fact, a part of it, the pupils meeting two days in each week at the industrial school and giving four days in each week to their books; and so successful was their work and so well had the pupils acquitted themselves that one of the teachers told me there was a far greater demand for help from these schools than could possibly be supplied. Why? Because these boys and girls had been started on the right road. They were taught industry and proficiency, and there is never a time when skilled labor is not in demand.

It should be every woman's pride to know how to work. Some will do much, some less. I have frequently met young ladies who boast that they do nothing. One lovely young girl said to me once: "I don't know how to do a thing. I can't sew and I don't know how to cook; and I never make my bed, we keep a girl and I don't have to."

To such I can only say, we should have had a school that at least taught you that it was an accomplishment to work. There have been many cultivated women who have considered the management of their own home their rarest gift. Even Mrs. Somerville, who was famous for her mathematical and astronomical skill, was justly celebrated for the beauty of her needlework, and the amount which she did. She was also an excellent practical housekeeper, and withal lived to be ninety years of age. Of course she may have had more and better brains than some of us, but we may educe, draw out, develop many things in our brains if we will. There is an old adage which I like: "If the iron be blunt and we do not whet the edge, then must we use more strength." 'Tis the systematical education that puts the edge on the dull brain. Many of the poorer girls feel that work is degrading; they are competent to do no work well and drift about from place to place trying to find something to do which to them may seem respectable. They finally marry; they can't cook, can't make their own or children's garments, they are extravagant and wasteful because ignorant; they live on baker's bread and watery potatoes and with bad cooking and a ceaseless outgo, it is no wonder some men become discouraged and take to drink. I believe some of this disaster could be averted if school life were devoted to a practical and industrial education, and I believe the time is coming when there will be a like education for the fuller development of men and women in our public schools, and the higher education will remain for those who may choose, after the more practical things of life have been learned.

You may say, my friends, that these things should be taught at home; but remember I am talking about the laboring class where the mothers may be ignorant or in poor health, or may be obliged to support the family. If an education for the poor means anything, it means to assist one in becoming competent to maintain himself.

These training schools are in successful operation in Boston, New York, Philadelphia and Chicago, and I believe that for the price we are now paying our singing teacher we could establish a training class for boys and girls.

Now some one will say that I am opposed to music. That is not the case. I only find myself asking, of what use is it to the pupils for whom the schools are supported? And I do say as much as I love music, that if I were to choose whether my child should be taught to sing, or to use the rule and plane, or to cut and make a garment, or the principles of household economy, I should most assuredly say the latter.

Under our present school system our boys, seeing no honor in industry, and with only a book training, are entirely unfitted for self support, and drift into the already overcrowded professions or lapse into a listless and idle state, little better than that of a tramp. They know nothing, are fitted for no work, hence can do nothing. Girls have nothing to do but to wait to be married, for they are equally unfitted for work, and they make poor wives and worse mothers. Among the poor, labor is thought to be the badge of poverty. Our schools might do much to elevate labor. This is no idle fancy; it is a practical idea. It is not overtaxing a child. Where it has been tried the children turn with a zest from head work to hand work. I think almost any adult would be amazed to know the mental work that children are compelled to do. I speak more especially of the city school, where brain and eyes are busy all the day with no recess. A celebrated French scholar while in this country, visited the schools. After taking all the details, he anxiously inquired; "And do the children live through all this? Why such work and discipline would kill a French army."

It is time that we as women and mothers demand practical things for our children. Let us importune the school board to discard some of the practically useless studies from the curriculum, and give us a practical and manual training for the youth.

Our child is taken from our control at a tender age; we are taxed for his education, and we of a right demand that our whole child be developed in the best possible manner to make him a good citizen. We do not want the children overfed physically, neither overtaxed mentally. We want head work and hand work, and a moral training irrespective of any sect, simply to make the best men and women for the future.

My friends, there are still greater heights to climb than those to which woman has risen since paganism and these are to work for the more perfect education and elevation of our sons and daughters. Women, under the law, have the consolation of knowing they are classed with idiots, paupers and children, inasmuch as they are debarred from exercising the right of franchise, but how grateful are we that we may have a voice in the education of our offspring.

Nature is compensatory. If we as women have disabilities, still are they equitably balanced by commensurate privileges. So men and women in the matter of education are equals, but not identical associates—not rivals. New truths are unfolding to our view hour after hour, like the perfumed petals of beautiful flowers through the long summer days. Not without storms, but all the better for the purification and vigor they impart, and those coming after will gather in our treasures of experience and knowledge. And in proportion as women come to recognize as their highest standard of work, the elevation of themselves and the youth in general, in that proportion will their labor be a success.

But whatever we find to do, let us glory in being women, and let us go forward earnestly and valiantly to accomplish our work, firm in the conviction and fearless in our assertions that with our best moral and intellectual development whatever is noble and honorable for man to pursue is equally so for ourselves.

WOMAN'S EMPLOYMENT.

BY MRS. GEORGE A. PERRY.

[Read at the Charlotte Institute, February, 1887.]

Much is being said and written nowadays upon the subject of "Woman's employment;" how "far she shall go and no farther;" why she shall go at all, outside the limits of her conceded "sphere," what she shall receive for "going," and how the departure will affect herself and humanity.

We are told by a recent contributor to the North American Review that "there is growing a widespread neglect of and opposition to marriage because women are beginning to find out that they can support themselves." Someone says in the Popular Science Monthly "that the present effort of woman to invade the higher forms of labor is battling with the established order of sexual relations," that "the Almighty has established bounds beyond which woman cannot go without defeating the primary object of her creation." A contributor to the Pall Mall Gazette takes the opposite extreme and urges that woman enter every field for which she proves herself fitted, saying that there is no reason why women should not become drivers and conductors of tram-ways—citing Chili in the late Peruvian war as being compelled to call women to such work, as the men were all engaged in military service—adding that "such satisfaction was given that owners of lines kept them on the cars, where they may be seen to-day in Santiago and the other towns, clad in a tasteful uniform, and doing their work without the aid of men." He further asks, "why in the name of justice is it any more unwomanly to be a female car-driver and thereby keep body and soul together, than it is to drive a fancy vehicle through crowded streets and parks, with only a tiny page at the back to represent the man?" Whatever ground is taken between these two extremes, we must admit that though the sacred relation of mother was fore-ordained for woman a large number of women must fail of their ordination.

There is a large class who, having a high ideal of manhood and marriage, prefer a "single life" to the desecration of that ideal by accepting in a husband a standard of purity and morality inferior to their own. The broader a woman's culture and the higher her theory of marriage, the more is it her conviction that she has no moral right to become the mother of children in whom may be perpetuated, through that terrible law of heredity, the vices of a dissolute father. This growing tendency is only to be obviated by a higher type of manhood, and this can only come of a complete revolution in public sentiment through that beneficent home training where father and mother by noble example and precept, shall instill into the mind of son as well as daughter, the emancipating gospel of the White Cross. Then, and not till then, will this revolution be accomplished, and the sanctities of fatherhood be seen to exceed all others to which a manly spirit can attain in this state of existence; and the malarious dreams of wicked self-indulgence shall slowly but surely give place to the sacred self-restraint which waits to crown with all good fairies' gifts the little life which noble love alone may dare invoke.

Miss Frances Willard, that noble and brilliant adherent to this lofty ideal, gives us a happy prophecy. She says: "Enough specimens have strayed into this century to show his outline and make us sure that the 'coming man' is not far off. Womanhood in the new age will rejoice in his companionship, and thousands now bravely living their true and individual life alone, shall find him in the world unseen, and like Endymion to Diana in Longfellow's sweet words:

'Shall whisper in their song,
Where hast thou staid so long.' "

There is another obvious reason why marriage is not possible for all. Plainly stated it is this. There are not men enough to go round.

There is not a nation in Europe to-day where women are not in the majority. The same is true, on a smaller scale, in our own country. In Massachusetts women outnumber men by seventy thousand, and all this in face of statistics which show that there are more boys than girls born into the world.

We may wonder at this seeming paradox, but the wars innumerable which deface the pages of all history have told the story for the past, and still today war kills its thousands, but licentiousness and strong drink kill tens of thousands; these latter causing, in our own America alone, the death of from 60,000 to 100,000, chiefly young men, each year.

Now, in addition to this feminine majority, who, if unarmed for self-support, are out at sea without helm or anchor, there is perhaps a larger class who, in marriage, fail to find safe harbor from self support. Through the misfortune, shiftlessness, dissolute habits, sickness, death or desertion of their husbands they find themselves compelled to earn the whole or a part of the family living, in addition, perhaps, to the work of the home. Such instances are not rare. Not one of us but can recall enough to make us sick at heart.

It is not safe, then, to educate our daughters as though marriage were a certain thing or a guarantee against the need of self-support. A thorough knowledge of some business, trade, or profession which will make self-support possible is every girl's right and might, and whatever is chosen, there are certain qualifications which should underlie the special preparation for any work.

Prominent among these is a knowledge of common business principles, one of which is illustrated by the immortal Micawber: "Annual income, £20; annual expenditures, £20 0s. 6d.—result, misery. Annual income, £20; annual expenditures, £19 19s. 6d.—result, happiness."

Our girls should have the discipline of actual experience in money matters at an age as early as practicable—say ten years—twelve at most. Every girl should have some money—her own—to provide for certain outgoes, and with the beginning of expenditure should come a keeping of accounts. As she grows older, having shown herself worthy of the trust already imposed, and very happy, I dare say, in her new responsibility, new ones can be added, until at sixteen any girl should have developed a business faculty equal to the transaction of her own expenses, with the counsel of older experience, which the business man himself is not loth to seek in the larger affairs of life. The parent can estimate the amount necessary to provide for the year's or season's wants. The amount can be given in monthly or semi-monthly installments when possible, and then an excellent plan would be for her to deposit the amount in a bank in her own name and pay all her bills by check or draft. This will be the means of a good deal of business knowledge and provide against the temptation to extravagance which might come of having money in hand.

Economic plans and estimates will begin to unfold themselves as soon as it is known that so much is allowed for certain necessaries, and the balance can go for some coveted treasure or, better still, for deposit in a savings bank, which deposit may become a nucleus around which a competence will ultimately accrue, and the foundation of a habit of economy as good as money against a time of need. Parsimony need rarely be feared. The tendency of the age is in the opposite direction.

All this may seem like a good deal of trouble to a parent—it should be a pleasure; but whether pleasure or trouble, it is one of the duties which parents owe their children as much as they owe them food and clothing.

The value of money can best be learned through the practical knowledge of its purchasing power. Some fathers may think their daughters cannot be trusted with money. It is not an unheard of circumstance for them to think the same of their wives. It would not be strange if it were often true. Wives and daughters are so accustomed to getting money only to meet the absolute emergency of the moment, that it is no wonder if in many cases "to have" comes to mean "to spend." Many an unconsciously extravagant wife or daughter might be transformed to examples of prudence if they were once given an opportunity to exercise judgment and economy. We doubt not but David Copperfield's poor little Dora would have been a more hopeful case had her experience in accounts and purchases begun earlier in her childhood home.

In this matter of home practice a father can give his daughter a larger experience by allowing her to do some of his own business. Trust her to send a money order, buy a draft, deposit money, compute interest, or write a receipt, and you will see her take a pride in the knowledge of forms and principles which had heretofore seemed so dry and incomprehensible. A parent with sufficient means can go still farther, by giving her some piece of property for her own exclusive care and management, of course with parental advice.

I am pleased to see a tendency toward the practical in the teaching of arithmetic in many of our schools. The little boys and girls in our own ward are sent on imaginary errands with quite incredible sums of money to make purchases at the various business places down town, to return with the requisite change, and not a few of them supplement this pleasant practice by actual errands where considerable mental effort is required. Our superintendent also puts such of her own business as is practicable in the hands of pupils, acting upon the principle that an ounce of practice is better than a pound of theory.

In Germany every girl is taught accounts as a part of her training toward housekeeping, and more than this, every girl, rich and poor, serves one year's apprenticeship in the family of some one of her own rank to learn every branch of housekeeping, mending and plain sewing included. And these qualifications do not stand second to business habits as a basis of education. The large majority of girls will become mistresses of homes, and whether they do or not, or whether they do their own housework or not, in the latter case it is a safeguard in the emergency of no help or incompetent help, and in the former a means for self-support in time of need. The idea that anyone can do housework or that no special preparation for it is needed has led to a deplorable condition of affairs generally, in nerve-worn women, poorly regulated homes, cross husbands, family jars, inefficient domestic service and the spread of that false sentiment which is abroad in the land that housework is degrading. Any young lady of intelligence and efficiency can command respect and honor in any family where respect is worth having at housework.

There are families in this town, and in every town, whose influence, by way of association, is a liberal education to their conscientious housemaid.

A rising author has said that Elizabeth Peabody (author of the American Kindergarten, and sister-in-law to Horace Mann) has done more for him than Harvard College. So I say that the helpful influence of an ideal home wherein reign love, harmony, culture, system, has done more for many a poor girl than all she ever learned in school. Their remuneration is not simply two dollars a week and board but an apprenticeship to "good housekeeping" in an earthly heaven.

I know whereof I speak, and if my daughter were compelled by necessity to go out from home to earn her living I would a thousand times rather see her safely harbored in such a home, in healthful employment, noble associations, with access to good reading and time to read, than unsheltered from any home, with one or two miserably comfortless rooms, to eke out a living behind some counter, or in a dark or poorly ventilated milliner or dressmaking shop, bent over work from dawn till dark, poorly paid, in the mistaken notion that she was thereby preserving respectability or following a higher calling.

Honest labor is only degrading when ill performed, and then the performer is responsible for the degradation.

With the present cheap price of wearing apparel, one can dress well and lay away a balance on two dollars a week. An efficient housekeeper in one of our best families has done all this, and put money at interest.

We are too apt to be deceived by the glitter of appearances.

The circuit court stenographer, who gets from ten to twenty-five dollars a day, may seem to hold an enviable position, but the carpenter or farm laborer is more to be envied, for the nerve destroying employment of the former can never be compensated by any salary.

You may envy the judge on his bench, but if he does not spend from two to three hours a day in some vigorous manual labor, he will, in a few years, be rather the object of your sympathy.

Gladstone has preserved health and vitality to a vigorous old age, but the ax to be seen in his hallway is a key to the mystery. Health is the vital principle of happiness, and the one who would preserve it and pursue an indoor or sedentary life must follow the example of the "grand old man," the advice of a Dr. Lewis or a Dr. Hall and take open-air exercise every day.

Many an ex-school teacher, book-keeper or dress-maker whose nerves have gone into bankruptcy have found the health which is wealth by taking up out-door employment entirely. All the way from California to the Atlantic coast it is being proven that these ventures are possible, healthful and profitable. A large capital of energy and stick-to-it-ive-ness, with a little ready money are all that is needed.

The reason so many fail in market gardening, small-fruit culture, bee-keeping or poultry-raising is because they do not pay the price of success in the way of preparation and application. The market gardening and small-fruit culture in and about large cities is almost entirely monopolized by Germans, a part of whose national inheritance is a habit of thorough preparation for work.

I would be glad to show, by examples, how women have shown themselves capable of this preparation, but time will not permit. In out-door work success has crowned her efforts. In California one woman sends out forty tons of raisins a year; in Minnesota women are successful wheat growers; in Iowa alone nine hundred and fifty-five women own or manage farms; in Kansas and other Western States many unmarried women are taking advantage of opportunities and locating farm lands. It is a fixed law in political economy that wages fall whenever the supply of helpers exceeds the demand for help, for no one will pay six dollars for work that some one else is eager to do for five; this is in the nature of things and not because of the oppressiveness of employers. The only remedy is for women to seek out some employment where skilled help is in demand, and such places are plenty. Gail Hamilton says, with her characteristic custom of sending causes of unhappy results home to the sufferer: "The two hundred thousand working women in New York City make machines of themselves and then wonder that they are treated as machines. They do not choose to use their brains, and then wonder that they are treated as if they had no brains. They choose the narrowest possible path and wonder that they are crowded," and we feel the wisdom of her words. From across the sea comes a more pitiful cry and the suffering comes from the crowded ranks of these same "machine workers."

We are told upon good authority that it is poverty and not religion which is filling the convents of Europe, and the philosophers and philanthropists of the "old world" are urging that every possible activity be opened to these suffering millions of working women. Do we need stronger argument for wider fields of work? If so, let us look at the successes which have attended the pioneers in ranks which a half century ago were deemed de-womanizing or beyond her capabilities. Dr. Elizabeth Blackwell received the first medical diploma ever granted to a woman in America, and her successful buffetings with the seemingly inevitable, opened the way for that small army of medical women who grace the profession to-day undisturbed by the fierce storm of opposition which assailed their predecessors. Catharine Beecher and Mary Lyon opened the way for women to higher education, each founding an institution. Caroline Herschell and Maria Mitchell in the science of astronomy have commanded the deference and admiration of the world. Rosa Bonheur, Harriet Hosmer and Anne Whitney are representatives of a class undreamed of in the time of Michael Angelo, and whom the world of prejudice was slow to appreciate in their own time.

Christine Ladd of Johns Hopkins University is one of the ablest writers on mathematics to-day.

But why lengthen the list which is glorified by such names as Miss Seymour, Mrs. Walton, Elizabeth Peabody, Frances E. Willard, Mary A. Livermore, and a host of others, whose success shows full well that woman is entitled to the world by her inheritance, and there are few places where real skill and brain are needed which do not offer opportunity for those who possess them.

With a broad field open to woman there is but one word which can stand between her and success, and that word which should be emblazoned along highway and by-way, from ocean to ocean, through every walk in life, is "inefficiency," the bane of our American civilization.

Then to the query "How far," we would say: Engage in the highest employment of which your nature is capable and die with the consciousness that you have done your best.

WOMAN'S WORK ON THE FARM.

BY MRS. A. A. FREEMAN.

[Read at the Hanover Institute.]

Poets of all ages have sung of the beauty, glory, and independence of the farmer's life, and of the advantages he possesses over the inhabitants of towns and cities in being able to hold communion with nature in all her varying moods.

But the farmer's wife! Oh, where is she? What poet has ever sung of the freedom, glory, and independence of her life? Let us give a fair and impartial look, and see if we can discover in what it consists. Let us take the girl, from a home perhaps of a farmer, who knows or thinks she knows of what a farmer's life consists! She may acknowledge that mother has had a hard life, but with her it will be different. The young wife in her humble home looks eagerly forward to a bright future when united efforts shall be rewarded with plenty, and leisure for improvement. Work? Oh, yes! She is willing and glad to to do all she can, to plan to the best of her ability, to economize in every way, to help lay the foundation firm and strong that shall make them the proud and happy possessors of many broad acres of waving grain and fruitful orchards. The years go by, the family increases and cares multiply, but they are gaining, year by year, some years more prosperous than others, but still a gain, until twenty-five or thirty years with their springtime and harvest have come and gone, and the goal is won, the broad acres are theirs (or his rather), and the farmer, now at middle life or a little past, but in his prime, looks with complacency over his possessions—his smiling fields of grain, green, grassy meadows, the woodland and the sheep and cattle ranging over the pastures, his fine barns and outhouses, where he has stored all the conveniences of labor-saving machinery. But is this faded and careworn woman the bright and hopeful young wife of a score of years ago? While the farmer is looking hale and hearty, the wife looks worn and weary. She has realized all she anticipated in the way of labor and economy, but where are the bright dreams and happy anticipations of her youth? Has the competence that is theirs brought any more independence or freedom into her life? Is any part of the income given to her for her own unquestioned use, unless it be for the merest necessities? and do even those come in every instance freely? Is hers the privilege to occasionally purchase for her own improvement and enjoyment a few books or articles of taste and beauty, which she may feel she is justly entitled to after many years of cheerful toil and self denial.

The farmer is at liberty, if anything is going on in town, to ride out into the busy world of men and be refreshed by the contact, gathering strength for home duties and work; while his wife, as the years roll on, is more and more unable to get away from the unceasing round of daily toil and cares, until at last she loses interest for aught besides these same cares and duties which, while they pertain to the well being of the family, have a narrowing and belittling effect on the mind if there is no time or opportunity afforded for other things. A short trip once a year, even, would do much, and an occasional ride to town with the husband would give a stimulus to mind and break the monotony of the tread-mill round.

One instance can be mentioned of a young farmer in another county who married a cultivated and accomplished girl, and every one supposed that he being a worker and driver, it would be hard for her to take up the rôle of a farmer's wife, but when it was seen that she was never absent from her accustomed place in the choir, at festivals, or anywhere else, and she was frequently called upon, being a fine musician, to sing and play, and even went out one season with an amateur company to sing in several towns, it was said by many: "Why, I don't see how Mr. B's wife can leave home as she does, her husband being a farmer." Some were so troubled as to speak to him about it. "Well," he said, "I did not marry my wife to make a domestic drudge of her, and have her grow old and careworn, but for a companion whose society I can enjoy. I don't intend to have those qualities which render her now so attractive, obliterated." Now he was not rich, and could no more afford to do this than many others, but he saw things from a different standpoint, and this was not a hindrance to his success, as he is one of the most prosperous farmers in his section.

EDUCATION FOR THE AGRICULTURAL CLASSES.

BY ALVA SHERWOOD.

[Read at the Three Oaks Institute, February 11, 1887.]

Nearly three hundred years ago Lord Bacon, the great father of inductive philosophy, expressed his idea of the value of education in the sentence "Knowledge is power," and since his time the greatest minds of all nations have accepted his idea and acted upon it. We take it for granted, then, that all intelligent people believe in education in general, and that it only remains for us to consider the subject of education for the agricultural classes. Farmers have been too generally imbued with the idea that while education is an essential to success in what they termed the "learned professions," it is not an essential to a successful farmer. They have taken the stand that theirs is not a business for thought but for action. They have sometimes said that "Providence has designed certain persons to lead and others to follow." This spirit is not in keeping with the principles upon which our government was founded, it is inconsistent with correct ideas of citizenship and can never lead to a high intellectual standard among the masses.

Every man is a free citizen and should exercise and develop his individuality. We deny to any class the monopoly of thought. Let us do so as independent, rational individuals, capable of exercising and enjoying the powers which God has given us. As Bacon has said: "Read not to contradict and confute, nor to believe and take for granted, nor to find talk and discourse; but to weigh and consider."

We suggest that the reason why some tillers of the soil have argued that education is not essential to success in farming, is based upon improper definitions of the terms used. In order to discuss this question intelligently it is necessary to define what we mean by education, and what our idea of success is.

In regard to education we desire to say, that any system which has a tendency to unfit the individual for his proper place in life is objectionable. It should never be the object of agricultural education (or any education) to enable its possessor to live without work, nor should the idea of making a living upon the labor of others be held out as an inducement for acquiring knowledge.

The legitimate results of culture are not to do away with hard work, but to bring our labor into harmony with nature's laws, of adapting our efforts to existing conditions and of making a wise application of energy, in order that our toil may be effective. It is only by education that we can hope to attain such a result. The operations of nature are regulated by fixed and inexorable laws, the manifestations of which are subject to many varying and sometimes conflicting forces, which may often seriously disturb results. The laws are nevertheless, certain, and he who ignores them is destined to reap the reward of disobedience. Nature places no premium upon ignorance by allowing punishment to pass because those who disobey her laws did not know of their existence.

Man has a nature which requires a variety of occupations for its proper development, study, meditation, society and relaxation should be mixed with physical toil. He is so constituted that he has intellect, heart, social tendency, taste and imagination, as well as bones and muscles, and no education is complete which attempts to educate one at the expense of the other.

President Eliot of Harvard has said that the fruit of a liberal education is not learning, but the capacity and desire to learn ; not knowledge but power. Accepting his definition the important question for our consideration is, how shall we acquire this capacity and desire to learn ? The answer in our opinion is, by a continued, systematic and well directed discipline of the mind, pursuing such a course of study as shall contain a large element of those departments of learning which are most useful in the vocation where we are employed.

With the highest regard for general culture, and with the belief that it should form a factor in all education, we yet realize that this life is too short for any individual to attain eminence in more than one direction, and that he who attempts to spread himself out over the whole field of learning is in danger of becoming too diffuse to be effective in anything. Steam must be confined before its power is apparent.

The present is preëminently the age of specialists and the highest success comes to those who make a life work of their chosen vocation. True education, then, cannot be measured by the number of studies pursued, but rather by the amount of discipline which the mind has received. Dr. Channing has said, "A man brought up to an obscure trade, and hemmed in by the wants of a growing family, may in his narrow sphere, perceive more clearly, discriminate more keenly, weigh evidence more wisely, seize the right means more decisively and have more presence of mind in difficulty, than another who has accumulated more book knowledge and enjoyed greater advantages. Many a man who has gone but a few miles from home understands human nature better, detects motives and weighs character more sagaciously, than another who has traveled over the known world and made a name by his reports of foreign lands. Such men have risen to their intellectual eminence by self-culture and self-discipline, not by accident. Their success shows that it is possible for some men to rise in opposition to circumstances, but while some succeed many fail to rise, who under better educational advantages in early life might gain such an impetus that final ascendancy would be assured.

The great majority of people receive their start in education in our district schools. The hope of our future, then, depends upon the excellence of these schools, and they are not receiving that substantial aid from the agricultural classes which they merit. The dignity of the teacher's position is not fully appreciated, and the great responsibility of training the rising generation in the ways of wisdom and truth and virtue is not always committed to proper hands. Too many of our district fathers, especially in the agricultural sections of our country, consider cheapness as the first and most important qualification of the school teacher. They seem to forget that with cheap teachers, as with other cheap articles, the quality usually corresponds with the price. We do not know of any relation in life where a lack of good leadership is more disastrous than in the school room. An inefficient teacher not only spends his own time to no purpose, but that of his pupils, and in the days when they should be acquiring a substantial basis for future usefulness and a taste for culture which may be developed in years to come they are really acquiring a distaste for study and abandoning their higher and nobler aspirations.

It is sometimes thought that if the farmer is encouraged to give time and strength to the elevation of his mind that productive interests will suffer. As has already been intimated, it is not to mere muscular force so much as to intellect, skill and applied science that men owe their mastery over the world. It is mind that conquers matter, and in proportion as the intellectual and moral forces of a community are developed, the productive and material interests will be advanced.

Science is one of the greatest benefactors of modern times. It has revolutionized the processes of manufacture in almost every department, so that what were once the luxuries of life, enjoyed only by the privileged classes, have become the common property of all. Scientific education has given the farmer improved machinery, improved domestic animals, more desirable fruits, vegetables and grains, and has raised the calling from one of common drudgery to dignity.

But the acme has not yet been reached. Let us have more education and thus improve the intellectual standard of the farmers. Education will make the calling more attractive and thus retain talent there. It will make it more profitable materially and will increase the comforts of humanity. Let us increase the effectiveness of our public schools by greater care in the selection of teachers, longer tenure of office, more months of school in each year, better salaries, and by regular attendance on the part of pupils. Show your interest in these schools by personal visits and by words of encouragement when they are deserved. Let us have a generation of farmers who are fitted for positions among men.

We believe in the working out of the principle of "cause and effect," which is so universally accepted, and that if the farmer fails to receive proper recognition, politically or otherwise, it is because other classes of men are better prepared for such positions.

But there is improvement. New forces are at work. The Grange, the great school for farmers, is being sustained and good results are apparent; but this is not enough. Give the rising generation more science, more systematic culture, more respect for honest industry, and let us advance until what Dr. Franklin called "The most useful, the most healthful and the most noble occupation of man" shall assume its proper position, and that which God intended among the activities of life.

DISCUSSION.

President Willits: I was for two years connected with the Normal School, and one of my duties was to seek out situations for our graduates, and as far as we could do so, we tried to place them in the towns and cities. Why? Because they could get better pay there. You cannot, as a rule, pay a cheap price and get a valuable article, either in teaching or anything else. I remember my father's insisting on engaging a University student to teach our school, and have always felt grateful to him ever since for doing so.

I don't know why school-houses are so often located in such dreary spots. I would make them places of beauty. Your children are to grow up there, and their minds will be affected by the influences around them. The difference between a dreary school yard and a beautiful one is a matter of so little expense that I cannot understand its neglect. A row of trees set along a highway, when ten or fifteen years old, will often add $1,000 to the value of a farm. And a school property so treated will raise the value of all the property in its neighborhood.

Hon. Wm. Chamberlain: The provision made for our public schools seems ample, but there is a difficulty in securing attendance. Suppose each township had a School Superintendent, whose duty it was to know all the children in the town and to see to it that they did attend, except when satisfactory reason for not doing so could be given.

Mr. E. K. Warren: As to the proportion of children attending our schools. The number of children from five to twenty years was canvassed, and we found but forty to forty-five per cent were in the Sabbath schools, and eighty per cent in the day schools.

President Willits: Was that true of one particular date, or for an entire year?

Mr. Warren: At that particular time.

President Willits: Then the showing is really more than the facts, for many of our young people attend at one time of the year, *e. g.*, in the winter, and not at another, so the percentage would perhaps be ninety per cent.

THE FARMER'S EDUCATION, WHAT HE CAN DO FOR HIMSELF.

BY J. WESTON HUTCHINS, A FARMER.

[Read at the Hanover Institute, February, 1887.]

That the farmer needs to be educated is no longer denied.

The theory of former years, that one-half the world should do the thinking while the other half does the working, is obsolete. We have learned that the object of education is not primarily to train lawyers, doctors, or farmers, but to train men; not so much to fill the mind of the student with a fixed number of selected facts, as to develop character; to lead the mind to correct thinking and the man to right living. Not knowledge alone, but knowledge and discipline—a discipline which reaches the whole man—intellect, feelings and will, is the two-fold object of education.

All these results the farmer needs as much as others. But how shall he obtain them?

Few farmers have an opportunity during their school days to become familiar with any but the most common studies.

Many are hedged in by circumstances over which they have no control.

The grown up sons, whose services are just becoming valuable, cannot well be spared from the home and farm. Many fathers seem utterly indifferent to the possibilities stretching out before their boys.

Many young men fail to appreciate the value of an education until too late. Others have received an education fitting them, no doubt, for literary or commercial pursuits, but giving no answer to many of the questions which confront the farmer. Nature's half-hidden secrets, but half-hidden to one acquainted and in sympathy with her moods and methods, are to them the profoundest mysteries.

How then, shall the farmer who realizes the need of a wider acquaintance with those laws of nature, and the methods of operation most in harmony with them, upon which his success depends, gain that knowledge? It is no help to him to be told that the Agricultural College or other schools give just the instruction which he needs. The cares and responsibilities of life are upon him. Others are dependent upon his efforts for the necessaries of life and the comforts of home. As a citizen, he must exert himself in behalf of all that aids the welfare of the community in which he lives.

His children must be educated, that the mistake or misfortune of his life may not be repeated in theirs.

With all these demands upon him, whatever his desires, attendance at school is an impossibility. Is he therefore doomed to ignorance?

Evidently, all that can be done is what he can do for himself. Books, papers and the experience of others may aid him. But with these helps is self-education practicable?

We have given to schools and colleges a monopoly of the business of education.

A writer upon self-culture says: "What is within reach of the unaided student few have inquired, and he has been left to be something or nothing as chance might direct, for all agreed he could never be a scholar."

But what has already been repeatedly accomplished must be admitted as possible. Many of the world's most noted scholars, some in every department of learning, have been self-taught. Who can read the life of Franklin, becoming by his own exertions the leading man of his day in science, philosophy and statesmanship; of Elihu Burritt, "the learned blacksmith," who while following his trade and supporting his family, masters nearly every known language, studying with his book upon the forge; of Hugh Miller, the Scotch scientist and author, who, from the age of 17 to 34 worked as a common stone mason, filling his leisure time with the study of literature and natural history; of Edison, the greatest electrician of this age, who had scarcely eight weeks' schooling, and is entirely self-taught—who can follow the career of these and many more we might name, and doubt that self-education is practicable?

Of course, no one will choose to educate himself if school education is possible for him. You do not walk to a distant city when you can take the express. But if you have nothing with which to pay your fare, or the last train be gone, rather than fail of reaching your destination, you will make the attempt. True, it is hard work, and much time is lost. You use this means because it is your only method of gaining your object.

So of self-education. It is not an easy task. Knowledge cannot be gained by wishing. To obtain it you must pay the price.

The student at college spends years in hard study, though aided by a teacher, and every means of illustration.

The unaided student can find no short cut. There is no royal road but through persevering, unremitting, self-dependent exertion. Along this road have traveled many whom to-day the world loves to honor. It bears the footprints of every inventor whose crystallized thought now lessens the burden of human toil; and of every discoverer who, passing beyond the boundary of the known has followed out the thought of God in creation, and brought to light the hidden mystery of Nature's workings. All such are of necessity self-taught.

What college could have instructed a Newton in mathematics, a Davy in chemistry, a Franklin or an Edison in electrical science? They passed by their own efforts, beyond the ken of colleges, into the realm of the unknown. The path in which they trod, and by which they reached results so beneficial to themselves and to humanity, is a road royal enough for any one—a road in which no man need be ashamed to walk.

But to be successful in this work some qualifications are necessary.

The first and most important is an overmastering desire for knowledge, a thirst which is never slaked, a hunger never satisfied; which makes present attainments but a stepping-stone to higher results and more active progress, and gains with every advance a broader view and a more determined purpose. Without this desire the numberless objects which attract the attention and pass away the time will leave no opportunity for study.

A word of caution may be needed just here. He who, to gain knowledge, deprives himself and his family of the enjoyments of home, who can find no time to romp with his children or visit with his friends, who values learning above religion, and starves his soul to feed his brain, makes a false estimate of life, and pays too high a price even for knowledge.

Another qualification of great value, if not a necessity, is contentment, the ability to look upon the bright side, to make the most of one's circumstances and surroundings, and though life may not be what the dreams of youth had pictured it, a willingness to accept the situation, and out of disappointment wring success.

A third qualification much to be desired is the power of concentration; the ability, when a leisure moment comes, to drop business or pleasure, and give the whole mind to the work. Let no one be discouraged because he does not possess this, for it is a result of study, rather than a requisite for the beginner.

Dickens says: "The one safe, serviceable, remunerative, attainable quality is the quality of attention. It will grow in the poorest soil, and in its good time, will yield both flowers and fruit."

Having resolved to do what you can for yourself in education, there are two practical rules which you must follow to be at all successful:

First: Begin.

Second: Keep at it.

Obedience to these simple rules insures a degree of success dependent, of course, upon the mental ability of the student; the quicker the perceptions and the stronger the intellectual grip the more rapid the progress.

But when and where begin?

There is no better time to begin than your first leisure minute. Busy people have very few hours to give this work; all depends upon the right use of the minutes.

There is no business which gives so many opportunities for thought and study as farming. The winter with its long evenings and dark mornings is especially favorable, and much of the work in summer becomes, by constant repetition, mechanical, allowing the mind to be busy with its work while the hands are doing theirs. While following the plow or the harrow, how many outlines of history may be mentally or audibly reviewed.

The use of the voice is quite an aid to the memory. If any one should hear you, he may think: "That crazy fellow is talking to himself," but what of that?

How many gems of literature, stored away in the mind in moments of leisure, may, at such times, be repeated and their beauties admired. How often will plant, bird, insect, or stone bring to mind a fact of science, leading us to apply the knowledge gained at other times.

When nothing else is at hand, the bare ground at our feet and the ever-changing panorama of the sky above us may furnish a subject for thought or an object for admiration.

Opportunities for study are not wanting; willingness to improve them is the greater need.

Where to begin is a question each must answer for himself. Wherever the starting point may be, a definite line of work is of the greatest value—a necessity to real progress.

"One thing at a time," or if the mind tire, two or three subjects may be followed at the same time. The fewer the better, however. A good rule is to begin with what you are anxious to know.

If too difficult for you, experience will soon show that you lack, and suggest the preliminary work necessary.

All should be acquainted with current history—what is going on in the world—and for this the newspaper is the best and only text-book. The farmer who would rank in the front must study his agricultural paper. Of course he will take at least one. What he can learn from the experience of others is time and money saved. The scientific principles upon which his art depends are there given, frequently by the best authorities.

Of subjects to be studied and books treating upon them, there is great opportunity for choice.

Here is where guidance is most needed. If at a loss to know what to choose, examine the course of study in any good high school. Select what you want and are prepared to undertake.

Better yet, if your time permits, join the Chautauqua Literary and Scientific Circle, read its four years' course in history, literature and elementary science and follow that with the three years' course of the Chautauqua School of Farming. These, arranged by the best talent, and under the guidance of some of the best educators, offer an opportunity to home students never before equaled.

Above all, do not try to read everything. You have no time for the valueless. It may satisfy curiosity to read that a traveler had his pockets picked while changing cars in Chicago; that a man, whom you never saw, and whose name you will not remember five minutes, was murdered in one of the back counties of Texas; to mix romance and religion, politics and poultry, facts of science and records of sin, swallowing the whole without thought or comment, and forgetting it all within an hour, but the result of such reading is a mental dyspepsia in which the mind fails to retain what is of value.

Better read one good book and know that one, than read everything and know nothing.

Having adopted a plan suited to your tastes and present acquirements, keep at it. To make resolutions is one thing; to carry them through to success is another and more difficult one. This is where the strength of your purpose and your staying power will be tested.

Keep at it. If your leisure be five minutes, use it; if it be an hour, make the most of it. In the house, have the book you are studying where you can reach it while resting. Carry pencil and paper with you and jot down any questions or any thoughts that seem of value. Experience will suggest many other methods of making the most of the minutes. Only, having begun, keep at it.

"But," says one, "I don't propose to make a slave of myself." Very well! There is no compulsion. It is simply a matter of choice. But he who will not pay the price must not complain if he fails of the reward. To one who has a genuine thirst for knowledge, the toil itself is its own reward.

"I have no time for study," says another. But you found time to read a two-column account of the latest murder, with all its sickening details of crime and blood. May the time yet come when particulars of crime will be left to courts of justice, and its soul-polluting stream no longer poison the minds of the people! You found an hour the other day for gossip at the village store; and who knows how many hours you spent last week trying to beat the champion at checkers? Innocent amusement perhaps, but how much of value might be gained in the time thus wasted!

Another objection is that one can never master so many sciences and "ologies." But no one is expected to know everything. The day of walking cyclopedias is passed. In fact, a man must consent to be ignorant of some things in order to know anything thoroughly. Education does not depend so much upon a smattering of everything, as upon a thorough mastering of what is undertaken, not upon facts alone, but upon intellectual power. The ability to think correctly, connectedly, and continuously is the true test of education.

The present century is noted for the extension of educational advantages to all classes. It is an age of active thought, and of the sharpest competition.

The farmer is perhaps the least affected, but at every turn he is pushed and jostled by the rush and tumult of the world around him. He who would keep abreast of the tide must have every faculty alert, every power developed. No amount of knowledge will come amiss, for in no pursuit is such a variety of questions presented for decision. His early training may have been defective, but he may still do much for himself. Especially is this true of the young men fresh from our schools, with a habit of study at least partly formed. There is every motive to urge them to undertake the work. Talent for success can no longer be measured by a lifting machine. Mind, not muscle, takes the lead.

The farmer's financial success depends more and more upon what he knows, and the judgment with which he uses his knowledge. Science has become his servant, and in every department gives him her aid. Toil he must; but he must *think* or his toil will be fruitless.

Neither can he longer complain that all positions of honor and influence are closed against him. Let him but have the training necessary, and doors for usefulness will open before him in every direction.

In national affairs his influence might and should be more potent than it now is. Vast social problems whose solution will affect not only the present but future generations as well, are calling for decision. The decreased production over extensive areas of our country shows that, in his own province, the farmer has yet much to learn. The withering blight of the liquor traffic, destroying the food value of farm products, and cursing humanity with its poisonous compounds; oily-tongued monopoly, laying its grasping hands upon the profits of labor; socialism and anarchy, flaunting their blood-red flag upon our shores, all threaten the very existence of our republican institutions. Upon the conservative, level-headed, intelligent farmers of this land rests the settlement of these important questions.

Whatever the amount of knowledge or the degree of culture there is room for its fullest exercise.

Let him, then, who would reap the best possible results from his toil, who would elevate his calling in the eyes of the world, who would have his influence felt in behalf of truth and right, give every leisure moment to self-improvement, remembering that the most profitable work ever done upon the farm is cultivating brains.

DISCUSSION.

Prof. Lewis McLouth: There is no such thing as standing still mentally, one advances or recedes. Instead of taking up the advocacy of specific agricultural training only for the farmer, I am glad that Mr. Hutchins recommends more general culture—that he actually advises the farmer to study history! This is wisely advised, as for mental health we need a variety of mental occupation. We need something aside from the main work of our life, something as a rest and recreation for our minds, and this conduces to our mind's strength and balance. There are other studies that, while serving also as a recreation to the mind, have a special bearing upon and a practical application to the business of farming.

Nothing can be more interesting than the study of scientific botany. The adaptability of plants to climate and to soil and questions of this kind are most interesting and will give mental rest and refreshment, and at the same time are at the foundation of scientific agriculture. So zoölogy, physiology, and chemistry are studies that have extremest interest and yet directly underlie scientific agriculture.

Now I shall take but a moment, but I could but ask one question.

Why do we hear the term "Learned professions," theology, medicine and law? Why need the law be more a learned profession than agriculture?

Is brain more needful in the trial of a $2.50 suit than in solving the problems that confront the farmer?

Agriculture opens up all the great problems of nature in which we may discern the very workings of the Almighty mind, and I verily believe that the time will come when agriculture will be considered one of the "Learned professions."

We hear of a great variety of fertilizers for the farm. The most needful one of these is that form of phosphate constituting the gray substance of the brain.

Mr. Wetmore: It requires a broader man for a successful farmer than for anything else. He must be a mechanic of great versatility, a builder; in fact a jack of all trades and master of each.

He can find however, a money profit in devoting a good deal of his leisure time to study. Suppose for example he reads the Scientific American regularly. He will gradually grow by many a bit here and there. If he always has a book to take up at odd moments—say like Winchell's Vestiges of Creation or Dana's Geology, he will in course of a few years find himself becoming well posted.

Mr. Geo. Willis, of Moscow: It is all very well to get an education, but an old pioneer will shake his head when you talk of all this leisure. When we have done twelve to fourteen hours labor, we have little energy to grasp a scientific problem. I believe that we need an education, but there is little energy available for that in the midst of the labors of the farmer, and I would urge that our boys should utilize their time in that direction, and for this reason I rejoice in our Agricultural College.

Mr. Wetmore: Wendell Phillips says a graduate of our schools has nothing that the community will give him a cent for. He has only learned to handle the tools. His real education is the practical, every day experience of his life.

Prof. Bailey: Book farming, or a system of instruction that can be directly applied to practice, is now better thought of than formerly. I remember a young man who, with no practice whatever, undertook small fruits with the help of a book on the subject, and succeeded admirably. Another undertook and succeeded in onion culture in the same way. How often people try to follow books blindly, without common sense, and with such a lack one cannot succeed, even in book farming.

President Willits: One word as to a feature I have heard nothing about. A study of the markets and keeping posted on these. You go to a merchant and say: "What do you ask for a yard of cloth?" and you go to the same man and say: "What will you give for a bushel of oats?" The farmer fixes the rate neither of what he buys or sells. Why? Because he knows nothing outside of his fence lines. He is not posted as to the condition of the markets. The merchant says: "I cannot sell that yard of cloth short of six cents;" but they don't ask the farmer whether he can sell at any price.

Mr. Willis, of Pulaski: Now, as to whether a farmer can fix his price, I raise a question. The farmer can say to the merchant, "I won't take the yard of cloth at six cents," or "You can't have my wheat at ninety-four cents; I won't sell short of a dollar" The farmer is as independent in the matter as any one else.

INSTITUTE TALKS.

BY PRESIDENT EDWIN WILLITS.

[Being notes taken from remarks at the different institutes.]

A fair in the eastern part of Europe is a great market; a place where people gather from distant quarters for the mutual interchange of their products; and with these products they also interchange ideas, and thus these fairs become great educators and civilizers.

These institutes fulfill one function of those eastern fairs. They serve as a place for the interchange of ideas, where we who are directed by the State to study problems of agricultural science may find out what those problems are and what are their conditions; where we may learn from your experience and you may learn from our study.

Our own fairs serve another of the uses of the market fairs in bringing together the productions of different men and different places that they may be compared; that we may see the excellencies of each, the shortcomings of each, and from this comparison arises one of the uses of our agricultural colleges, viz., the study of the causes of these differences and the means of preserving and reproducing the good points and of avoiding the bad ones.

They are places for studying the how and the why of agricultural success or failure.

Thirty years ago our leading statesmen saw that widespread agricultural failure threatened us, that whole sections of the country were becoming gradually exhausted.

Every nation startswith a soil in its pristine vigor, fresh from Nature's hand. The first result of the footsteps of man is the blasting of that fertility. Large stretches of country have been abandoned to the wolf and the rabbit.

When in college I had a classmate whose family had just crossed from Mississippi to Arkansas. They had formerly moved from Alabama and before that from Georgia. They left exhaustion in their pathway.

I would rather have a "pine barren" farm than many of the formerly valuable farms of Virginia. You know after the war many Northern men went down South and bought farms with fine buildings for almost nothing, but they found they had paid too dear. The farms had no heart and would grow nothing—five bushels of wheat per acre was an average yield—they wouldn't take clover—they wouldn't even grow sheep! And Congress saw that the same process was running its course in the North. New England was always poor soil, but is now far more so than 100 years ago. You remember the Genesee Valley and its seemingly exhaustless fertility? Where is it now?

You remember the early accounts of the soil of Indiana and Illinois and how it was said that these rich prairies could never be exhausted, and how they were cropped and cropped until the corn crops dropped from 100 to 75 and 60 and 50 and 40 bushels per acre, and then the owners moved to Kansas, and from Kansas they will have to move on yet farther west, and, unless some better methods are learned and practiced, they will have to keep on moving until the Pacific ocean calls a halt and gives them the alternative of drowning, starvation, or reformation in methods of farming.

Do you remember the past wheat crops of Michigan? Twenty-five bushels of wheat to the acre. Then do you remember how you ran down to 20, 15 and 12 bushels per acre? Then you woke up to the situation and began to use science in your farming, and the tide was turned, and the product per acre is consequently on the up grade again.

Now the man who says that science is useless to agriculture is behind his times. He does not read the papers. But we have other problems before us at the Agricultural College beside the question of exhaustion of soils or rather the prevention of the exhaustion of soils.

We have it laid upon us by the laws of the State and of Congress, upon which our endowment depends, to work out the theory and practice of industrial education. Why called industrial? What is an education? It is a drawing out. What, then, is an industrial drawing out?

Our general and most familiar ideas of education have come to us from a time when men thought that the mind was everything, the body nothing. Hence came the idea of mortifying the flesh to advance the mind. I don't depreciate the grandeur of man's mind, but it is a misconception that it is necessary to suppress the body in order to develop the mind. We have learned that we develop the mind best by caring well for the body, keeping it in strong and vigorous trim. That man who has the best physique can accomplish the most. It is said Napoleon would have gained Waterloo had he not had an attack of dyspepsia.

The old schools, our literature, our poetry, essays, homilies, etc., etc., have taught that the body must be sacrificed to the mind. Paul was talking of unbridled lust and passion—not of the controlled passions. God gave us these as our agents and we are to control them and use them for what God designed them.

Starve yourself because you are a sinner? No. Take a good square meal and go on and do all the good you can.

Our boys in reading our literature get the false notion that there is no dignity in anything physical. As a consequence very often they are anxious to get away from physical labor, to get away from the earth and from sordid things. They don't stop to think that most professions are more sordid than the hardest farm work.

You say you're going to be a lawyer and to be at the top like Wm. M. Evarts. If you do that you'll do well. But if you seek to get away from work you will find that you can't do it if you're an honest man. There is hard drudgery everywhere.

You think you'll escape this by going away from the farm, but three-fourths of those who try it wish before they get through that they had never left the farm. A farm doesn't rot nor burn up, nor run away.

Industrial education is that which has coupled with it the use of the hand,—of the physical powers, and those men are the best fitted for life who are so educated. They are not one-sided. It is true there are certain advantages even in being one-sided, in being a crank. Most inventors and poets are cranks, but most of us will do better as whole men and whole women, so that we can do whatever work God has set before us.

The land grant says the purpose of our college shall be to give instruction in agriculture and the mechanic arts, and for the last two years we have had our Mechanical Department, and are succeeding, but the same question meets us from the machine shops that used to meet us from the farms: Will our boys stick to their business?

Yes! they do. It is not a true criticism that our graduates leave the farm; fifty per cent of them make agriculture, in one form or another, their after occupation, and a much larger per cent would do so if they had any capital to begin with.

It has even been said by ignorant enemies of the college that more graduates of the university become farmers, than of the college. The fact is that of university graduates only 2 per cent become farmers, while the professional schools are rare indeed where so large a proportion as 50 per cent of their graduates continue in the practice of their profession.

Well, I went to Detroit into the machine shops there and told them that we were going to establish a school of mechanic arts and said to them:

"Will you send us your boys?"

"No, sir! You'll teach them to be above their business.

"Our boys go to the high school and by the time they are juniors they have got such high heels you can't do anything with them."

Then I hauled off for repairs and investigated the college and looked into the matter of the students' work and found that all the boys were required to work. So I went back again to the shops with a new idea. They admitted their inability to make much of their boys. They are only taught to do small specific jobs like making bolts or pin heads. They could not teach them to be skilled, general mechanics. They had no means of teaching mechanical drawing. They said: "We have no apprentice system and when a boy does get some skill we can't keep him. Our foremen are all foreigners who have had foreign apprenticeships." In one shop they told me of a graduate of the Mechanical Department of Cornell University who had offered himself as a foreman but who had not learned and scorned the actual operations of the shops.

So, with what I knew of the Agricultural College, I said: "Suppose we take your boys and teach them drafting and all the foundation theory, and with that, have them work a couple of hours each day in the shop, at the bench or forge. Suppose we make them competent bosses and don't give them the big head." Then they said: "All right, go ahead and we'll send you our boys." Now, in this idea of combining labor with study, practice with theory; *doing with learning how to do,* is the key to the value of the college, and too, that is the reason why it will not realize its best possibilities in connection with a university. The gymnasia and athletics of other colleges do not make up for the advantages of this regular daily physical exercise, even as a health insurance, and they miss wholly the grand advantage of allying in a noble partnership the laboratory of the student with the life and action of the future man.

At our Agricultural College we have preserved intact the labor system. I am free to confess that I did not at first believe in it, but I am thoroughly converted.

I found at the university that along in May and June the students were pale and looked fagged out. It is called the result of over study. Nonsense! it is from lack of exercise. Gymnasia are not the thing needed. They have done more harm than good in multitudes of cases. Many a boy owes a serious illness to his athletics. But this combination of good, honest, manly labor with study, works no such ill effects.

You don't find our boys sick because of the two hours' work. It does them good. They eat more than the students of most colleges. Their digestion is better. They are developing the whole man, and meanwhile they are preserving their respect for labor and familiarity with it.

PLEURO PNEUMONIA.

You know the pleuro pneumonia. A year or so ago a gentleman imported to Ohio some fine Jerseys and one of them he sold into a herd in Illinois, and the first thing they knew their cattle began to die and some one said it was pleuro pneumonia. But who could tell? Who knew it except students of veterinary? They proved it and traced out all the exposed animals and condemned and slaughtered them. The only way to meet such an emergency is to have trained and educated men who can recognize the disease or other cause of trouble.

EXPERIMENTS.

I wish to say a word or two as to our hopes in the matter of the Hatch bill now before Congress. Our main foundation now is the land grant of 1862, of which the main purpose was educational, not experimental, so that most of our abilities go in that direction, but since the passage of that act there has been a strong demand for experimentation, and so our college has attempted to do what it could in that direction. I attended the meeting of the State Horticultural Society last December, and I found them anxious to have many experiments tried; and these our Prof. Bailey is working toward; for example, he is seeking now to test the possibility of securing a peach that will be hardy in the greater part of the State and an apple that will be hardy in Northern Michigan. Suppose in this work ninety-nine experiments in every hundred should be flat failures as far as any valuable outcome is concerned. It might easily be that the hundredth one would many times over pay for the entire outlay. Think what an amount of wealth would be added to the country by the addition of five bushels per acre to the wheat crop or the oat crop!

I used to consider the United States Department of Agriculture a waste of money, until I had occasion to investigate its workings and found that though there was a good deal of rubbish yet there were single hits which had been of more value than the entire cost of the department from first to last. One instance of an experiment in which millions of dollars was added to the value of the California wheat crop.

I used to think the State should undertake this work, but you know how impatient our legislators are for immediate results, and in this work immediate results are not often realized; but the United States Congress has larger resources, and twenty-five years' waiting for results does not seem so hopeless with the large interests involved, in the Washington legislation.

And so certain representatives of the Agricultural College united in formulating the Hatch Experiment Station Bill which, if it becomes a law, I think the next twenty-five years will not pass by without showing results that will repay many fold the entire cost.

EXHAUSTED LANDS OF MARYLAND.

At the Hanover Institute in connection with President Willits' remarks as to exhausted lands, Mr. W. Wetmore said: In 1845 I went to Frederick county, Maryland. It and Washington county were the best counties in the State—excellent wheat lands.

The farmers there had just taken up the idea of preserving the fertility of their lands with clover and land plaster, the plaster being brought from Nova Scotia.

They plowed the clover all under, being afraid to spare any for their cattle, and right there is where they made their mistake.

Live stock is the great manure mill and the clover should be run through it.

I returned in '52 and '54 and in '76. In the '50s they were all depending on plowing in clover and plaster.

In '76 all the plaster mills were grinding bones instead, and they were raising only 8 to 12 bushels per acre where they had raised 15 to 40 bushels. They were not shiftless farmers; they were "10 rail high" farmers; but their trouble had been in not running the clover through cattle. We must keep stock. The manure heap is the farmer's bank.

Clover without stock will not save the farms.

FARMERS' CLUBS.

BY F. N. SHEPARD.

[Read at the Bancroft Institute.]

The Grange, Farmers' Club, the Farmers' Alliance, and other organizations of a similar nature, all have in view the same object, viz: that of bringing the farmer to a point where he would not only know but would assume the duties and responsibilities of his position. While all other classes have had their organizations for years, it is but a short time that the farmer has had anything of the kind, and yet in that short time see what has been accomplished! We all know the work which the Grange has done and is still doing.

The Farmers' Alliance in some of the Western States, though but a recent organization, is making itself felt. Look for a moment at some of the results of this work. Were it not for the farmers' organizations, would it have been possible for a farmer to have been elected Governor of the great State of Michigan? Would the Interstate Commerce Bill and other measures designed to promote the prosperity of the people, have been passed without the aid of these organizations? In view of what has been done is it not wise for farmers to go on in the work they have undertaken? And as a means of education for the farmer I can think of no better organization than the Farmers' Club.

Though yet in its infancy the Farmers' Club is already attracting an amount of attention which bids fair in a short time to place it in the front rank as an organ for the education and advancement of the farming community. A few of the most desirable qualities of the Farmers' Club are its simplicity, its practical work, its independence, its educational qualities, and its social features. Having but few by-laws and rules of order and these of a nature to be easily understood, it seems to be the plan best suited to the farmer, who unlike the lawyer and politician, seems to have an aversion to complicated rules and points of parliamentary practice.

Taking up questions of vital importance to the farmer, and dealing with them in the most practical manner possible, each member discussing the question, giving methods which accord with his own practice, is, to those desirous of learning the practical details of farm management, most desirable. The Farmers' Club, unlike the Farmers' Alliance and similar bodies, is an independent organization having no State or National body to which it must be subordinate, and hence is trammeled by no laws except those of its own making, and is independent in its action and can take its own course as a body without any interference of a higher power. Although not a secret order, the fact that the membership of the Club is confined to a certain number of families, prevents the attendance of too large numbers, as is sometimes the case with bodies whose doings are of a public nature.

Here then is the place for an interchange of views on all topics of importance to the farmer. Not only are the discussions and essays of interest from what can be learned, but as all are required to take part in the exercises, it proves valuable in enabling the members to acquire that confidence in themselves and readiness of expression which is so desirable to those engaged in public business. Many consider the social features of the Farmers' Club its strongest point. Composed as it usually is of families living near enough to be tolerably well acquainted with each other, with the chance for social chat and friendly intercourse, with music as a part of the exercises, and last, though by no means least, the bountiful meal provided for the occasion, one can hardly help admitting that the social feature of the Farmers' Club is a very pleasant part of the arrangement.

I will only add in conclusion, my plea to you as brother farmers to organize, if not the Farmers' Club, then some other organization having the same great object in view, viz: the advancement of the interests, the education of the members, and the general welfare of the American farmer.

THE DEBT WE OWE THE PIONEERS.

BY MISS MOLLIE CARRUTHERS.

[Read at the Bancroft Institute.]

As I have been considering the advantages of this Institute to the people of our county, I have been constantly reminded of the work by which an entertainment, such as this bids fair to be, has been made possible.

We are proud of Michigan, proud of her agriculture, of her rapid advancement and of her financial standing; but do we not ascribe to later circumstances too much of the credit of our State's present standard, and almost forget the first rough work that paved the way for all the rest? We too easily fall into the habit of looking only at results and ignoring the slow beginning necessary to all great achievements.

The present excellence of the industry under discussion is quite as much due to the men who split rails for the first fences as to those who have invented the best methods for growing ornamental hedges.

The young farmer of to-day takes the farm which he is fortunate enough to receive by gift or purchase, but he is not so very glad to get it, nor does he think life on that farm so very desirable, but seldom does he think of the dead and gone farmer who cleared his farm, or of the enormous amount of hard labor he expended upon it. Why, it has been estimated that it takes a working life-time to get a farm into a first-class state of cultivation.

What can we know of the lives of those dwellers in the forest primeval? How can the college boy of to-day understand what it was to fell oak timber day after day, of long cold winters, and all the time think longingly of the schools back in "York State." Many a bright young man gave up a dream of Harvard or Yale and went on a new farm in Michigan, there to spend the best years of his life making the Agricultural College and the University possible for other young men.

And the pioneer mothers. We ought to reverence them, for the light of their tallow dips is shining brightly down through the years, and the good they have done lives after them. The hand that forty years ago rocked a cradle on the Western frontier, is to-day plainly visible in Congress and our Legislatures. The mother of Garfield only represents a type to which hundreds of Michigan's pioneer women belonged.

We are seeing the last days of a people whose work will never be duplicated in America's history, for the future settler of the West need never know the privations of the early Michigan farmers. The miner will hardly have staked his claim on the side of a Colorado mountain ere telephonic communication and daily mail are extended to him. And the Dakota settler! Little he knows of clearing new land or plowing among stumps. He comes from the crowded countries over the water, looking for room to rest his travel worn feet, and our government gives it to him—eighty acres of cleared land for each foot. It hardly requires a lifetime for him to get that farm into working order, and as to privations, the very latest improvements in farming machinery are right at his very door almost as soon as he is.

Now this is not to assert that a Dakota settler's life is all roses, but in point of clearing new land, it is in comparison with that of a Michigan settler, at least, the one to be preferred.

In regard to discharging this debt, this moral obligation under which we are, I want to mention only two methods: one is to take more care in recording our pioneer histories; the other, to evince more interest in those with whom we are personally connected. As to the first, we have a grand opportunity of learning history from the lips of those who made it, and how shall future historians justly compute the value of their work unless we thus assist them? The deeds of warriors are not forgotten because they are duly chronicled and preserved in the records of war. Soldiers of war march to the front, fired with ambition, urged on by enthusiasm, to gain death or glory, or perhaps both; but the soldiers of emigration were under no such inspiring influences. They waged a war with poverty and wild beasts, fever and ague, and homesickness. The stakes were a home and a heritage, and though they did not always win, they fought battles as worthy of remembrance as any ever fought under flag.

Not longer than two years ago, one of our county newspapers published a request for short sketches of pioneers' lives. and of interesting events in the early history of our county. I do not recollect that any response was ever made to the call. Now, why should not such sketches be made by those who may be interested in the work? They may not be literary efforts worthy of publication, but facts will thereby be preserved which may some day be of value. The tired old hands which have grown more used to the plow than the pen will never accomplish this task for themselves, and why should not some younger hand perform the office for them. We ought to take more interest in this work. We find time for everything else. We take plenty of interest in the men who sit in Washington, making our country's laws (and quarreling with Great Britain about where we shall dig bait), but we have no time to remember the men who worked in Michigan forests, making our country's wealth. It remains with us to decide whether they shall be remembered or forgotten. Shall we bring reproach upon our generation by relegating these old heroes, our benefactors, to oblivion? "If memory o'er their tomb no trophies raise," later generations will rightly impute the fault to us. We are submitting these battle-worn veterans to a last cruel test, and they are bearing it with what has been so aptly called "the heroism of never being heard of."

We affect to despise the "boast of heraldry," but 'twere well if our democratic principles do not carry us to the extent of completely ignoring the achievements of our ancestors. There is nothing snobbish in remembering with pride any act of an ancestor which may reflect credit upon his name.

A week from to-day the Pioneer Society of our county will meet at Corunna and listen to eulogies upon no fewer than six of their number who have dropped from the ranks during the past year. We shall then consider earth's duty to them fully discharged, but why should we wait until they are dead to say kind things of them? We write flowery obituaries for them, but methinks a little timely appreciation would be more to the purpose.

We have not a lifetime in which to consider the question, for before many years have rolled away the pioneers will all be gone to settle in another new country. We surely should not neglect this privilege of learning the details of a marvelous change, from the people who made it. The opportunity is going, the pioneers are dying, and the time is *now*.

ADDITIONAL REPORTS OF LOCAL AGRICULTURAL SOCIETIES.

[The following two reports were received too late to be printed in order.]

AVON AGRICULTURAL SOCIETY.

REPORT FOR THE YEAR ENDING DEC. 17, 1887.

January 11, 1887, The seventh annual meeting of the society was held at which the following officers were elected for the ensuing year, viz.:

President—John M. Norton.

Treasurer—Arthur E. Collins.

Secretary—Theo. Dahlmann.

Directors—J. Vanhoosen, W. M. Price, E. Brewster, I. Barwise, H. L. Lintz, W. Graham, E. H. Dewey, J. H. Stevens, and J. E. Curtis.

M. P. Newberry offered an amendment to Article 6 of the Articles of Association, which provides that "three directors be elected each year, whose term of office shall be three years." The amendment was laid upon the table, in pursuance to requirements of Act 43, Session Laws of 1879, of this State.

Membership during 1887, 183. Entries at fair of 1887, 1,283. Number of premiums awarded, 658. Amount of premiums awarded, $595.30 (a part of which were discounted 25 per cent, as will be seen by the following statement).

RECEIPTS.

Balance on hand December 17, 1886	$20 17
Error in report December 17, 1886	5 75
Premiums uncalled for December 17, 1886	17 33
Receipts at the fair October, 1887	751 50
Premiums uncalled for October, 1887	75
Received from other sources	32 09
	$827 59

DISBURSEMENTS.

Paid postage of 1886	$0 18
premiums of 1886	10 16
incidental expenses of 1887	331 24
for premiums on foot races at fair of 1887	40 00

Paid for other attractions	$5 00
purses for horse races	112 50
Orders issued for premiums on exhibits at fair of 1887	328 51
	$827 59

All of which is respectfully submitted.

Signed at Rochester, Oakland county, Michigan, December 17, 1887.

J. M. NORTON, *President.*
A. E. COLLINS, *Treasurer.*
THEO. DAHLMANN, *Secretary.*

UNION AGRICULTURAL SOCIETY OF ST. JOSEPH VALLEY.

[Litchfield, Mich.]

REPORT FOR THE YEAR ENDING DEC. 20, 1887:

Receipts.

Cash on hand January 7, 1887	$85 39
received from stock certificates	116 50
at gate	1,760 15
from grand stand	40 50
dining hall	221 82
horse stalls	69 00
booths and licenses	242 85
speed entries	179 00
all other sources	73 21
	$2,788 42

Disbursements.

Paid for labor on grounds	$392 68
lumber	386 02
on indebtedness	313 40
incidental expenses	482 06
insurance	17 50
for printing	44 97
rent of grounds	20 00
premiums	701 25
speed premiums	397 50
Balance	33 04
	$2,788 42

We hereby certify the above to be a statement of the receipts and disbursements of the Union Agricultural Society of the St. Joseph Valley, for the year ending Dec. 20, 1887.

R. W. FREEMAN, *President.*
L. B. AGARD, *Secretary.*
DAN H. MILLS, *Treasurer.*

SUMMARY OF METEOROLOGICAL OBSERVATIONS AT THE MICHIGAN AGRICULTURAL COLLEGE, FOR THE YEAR 1886.

BY R. C. KEDZIE, PROFESSOR OF CHEMISTRY.

[Latitude 42° 43′ 56″, longitude 7° 25′ 59.61″, height above the sea 834 feet.]

	Mean Daily Temperature in the Open Air.	Percentage of Humidity, Saturation = 100.	Pressure of Vapor of Water in Inches of Mercury.	Height of Barometer, reduced to Temperature of 32° F.	Percentage of Cloudiness.	Mean Maximum Temperature.	Mean Minimum Temperature.	Amount of Rain and Melted Snow in Inches.	Snow fall in Inches.	Number of Thunderstorms.
January	18°.78	91	.106	29,074	77	25°.0	11°.3	2.66	19½	------
February	22°.27	86	132	29.106	65	29°.0	12°.8	1.35	7	------
March	31°.33	80	.169	29.013	60	39°.3	13°.4	2.63	7½	------
April	50°.18	73	.356	29.130	57	60°.7	38°.0	1.99	5	2
May	58°.06	79	.457	29.036	46	67°.9	45°.0	2.67	------	3
June	75°.72	73	.589	29.068	47	76°.3	53°.3	1.92	------	4
July	70°.68	65	.711	29.064	48	83°.3	55°.8	.65	------	2
August	69°.30	71	.665	29.062	44	80°.3	56°.4	4.69	------	3
September	62°.07	80	.535	29.148	55	71°.7	56°.0	5.40	------	4
October	52°.37	73	.370	29.266	49	63°.7	41°.1	.95	------	------
November	33°.94	78	.182	29.061	64	41°.5	24°.1	1.48	2½	------
December	19°.74	87	.105	29.186	69	27°.7	8°.2	1.56	15½	------
Year	46°.20	78	.365	29.101	57	55°.5	31°.7	27.95	57	18

Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	30	37	35	34	100	71	80	.167	.182	.178	29.177	29.167	29.221	29.188
2	34	37	35	35⅓	90	100	100	.183	.221	.204	29 208	29.055	28.972	29.078
3	40	45	48	44⅓	100	100	100	.248	.300	.335	28.933	28.797	28.655	28.798
4	42	36	30	36	91	80	78	.254	.186	.143	28.594	28.622	28.715	28.644
5	28	23	12	21	100	86	100	.153	.111	.075	28.665	28.785	28.960	28.803
6	4	10	4	6	100	79	100	.052	.057	.052	29.110	29.050	29.221	29.127
7	6	63	12	10⅛	100	81	100	.057	.067	.075	25.211	29.213	29.195	29.203
8	14	14	15	14⅓	82	82	82	.070	.070	.074	29.070	28.862	28.667	28.866
9	14	11	10	11⅔	100	100	100	.032	.071	.068	28.569	28.629	29.728	28.648
10	10	15	5	10	100	65	100	.068	.055	.055	28.863	28.892	29.068	28.941
11	1	11	3	5	100	80	100	.046	.060	.050	29.154	29.203	29.364	29.246
12	4	8	1	4⅓	74	55	100	.041	.039	.046	29.387	29.332	29.332	29.350
13	0	18	8	8⅔	100	84	100	.014	.087	.062	29.361	29.406	29.571	29.453
14	11	28	23	20⅔	80	77	73	.060	.130	.100	29.570	29.557	29.562	29.563
15	22	31	30	27⅔	86	58	100	.106	.127	.167	29.457	29.275	29.022	29.251
16	35	35	18	29⅓	100	100	68	.204	.204	.075	28.808	28.845	28.913	28.855
17	16	21	16	17⅔	100	71	100	.090	.089	.090	29.130	29.178	29.278	29.195
18	18	26	22	33	100	88	100	.098	.129	.118	29.175	29.000	28.922	29.032
19	22	21	13	18	86	86	100	.106	.101	.078	28.865	29.042	29.286	29.398
20	11	18	20	19⅔	100	100	100	.071	.098	.108	29.316	29.123	28.957	29.132
21	14	24	20	19⅓	100	74	85	.032	.105	.096	29.098	29.224	29 268	29.197
22	22	20	-2	13⅓	86	85	100	.106	.036	.040	29.013	28.858	29.092	28.988
23	-12	6	-4	-3⅓	100	100	100	.026	.057	.036	29.524	29.526	29.498	29.516
24	-6	16	15	8⅓	100	83	82	.033	.078	.074	29.398	29.295	29.214	29.302
25	28	32	27	29	88	89	100	.142	.168	.147	29.029	28.926	29.062	29.005
26	22	31	26	26⅓	100	79	88	.118	.150	.129	29.282	29.283	29.231	29.265
27	25	30	23	26	100	89	100	.105	.155	,123	29.073	29.060	29.128	29,087
28	22	24	20	22	100	100	100	.118	.129	.108	29.025	29.992	28.987	29.001
29	20	27	16	21	100	88	100	.108	.135	.090	28.906	28.782	28.778	28.822
30	15	20	14	16⅓	100	85	100	.086	.096	.082	28.765	28.747	28.742	28.751
31	6	13	13	10⅔	100	62	81	.057	.055	.067	28.803	28.957	29.018	28.926
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	18°.78	96	83	94	.100	.116	.101	--------	--------	--------	29.074
Average						91			.106					

for the Month of January, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	St.	100	St.	100	St.	s	5	s	8	s e	4	39	30	--------	--------	------	------
100	Cu. St.	100	Nim.	100	Nim.	s e	6	e	8	----	4	40	34	11 a. m.	--------	------	------
100	Nim.	100	Nim.	100	Nim.	e	4	e	4	e	8	50	40	--------	--------	------	------
100	Nim.	100	Cu. St.	100	St.	s w	8	w	3	w	4	42	27	--------	10 a. m.	.74	------
100	Nim.	100	Nim.	100	St.	s w	5	n	8	n	8	28	4	--------	4 p. m.	.10	1½
10	St.	00	--------	00	--------	n	4	n w	6	n	0	10	2	--------	--------	------	------
100	St.	100	St.	100	St.	n	5	n e	8	n e	8	14	7	--------	--------	------	------
100	St.	100	St.	100	Nim.	n e	12	n e	16	e	12	16	13	7 p. m.	--------	------	------
100	Nim.	80	Cu. St.	00	--------	n e	16	n w	20	n w	20	14	10	--------	8 a. m.	.21	3
80	St.	80	St.	30	St.	n w	16	n w	16	w	1	15	-2	--------	--------	------	------
100	St.	40	Cu.	20	Cir St.	s w	6	n w	16	n w	4	14	-4	--------	--------	------	------
100	St.	20	Cir.	20	St.	s	8	s w	12	s	8	10	-2	--------	--------	------	------
60	St.	60	St.	00	--------	s	4	s	6	s	3	18	0	--------	--------	------	------
00	--------	20	Cir. St.	40	St.	s	8	s	8	s	6	28	11	--------	--------	------	------
100	St.	100	St.	100	Nim.	s e	3	s e	6	s e	12	35	22	3 p. m.	--------	------	------
100	Nim.	100	Nim.	100	St.	s	8	s	16	s w	20	36	15	--------	8 p. m.	.26	------
100	Nim.	100	Nim.	100	St.	s w	24	w	12	w	4	21	16	7 a. m.	--------	------	------
100	Nim.	100	St.	100	Nim.	s e	3	e	8	e	2	27	17	--------	9 p. m.	.30	4
70	Cu.	100	Nim.	90	St.	s w	16	w	16	w	8	23	11	--------	--------	------	------
100	St.	100	Nim.	100	Nim.	s e	2	s e	5	e	1	20	11	9 a. m.	10 p. m.	.70	6
00	--------	40	Cir.	100	St.	n w	8	w	2	----	4	26	14	--------	--------	------	------
100	St.	100	Nim.	00	--------	s	12	s w	20	----	12	25	-12	8 a. m.	3 p. m.	.10	1
10	St.	60	Cir. St.	90	Cir. St.	s w	1	s w	4	s	1	8	-12	--------	--------	------	------
10	St.	90	Cir. St.	40	St.	s e	1	s e	8	s e	4	22	-6	--------	--------	------	------
100	St.	100	St.	100	St.	s e	8	s w	8	s w	12	33	22	--------	--------	------	------
100	St.	100	St.	100	St.	n e	4	s e	4	s e	5	32	22	In night	--------	------	------
100	Nim.	100	Nim.	100	Nim.	n e	6	n e	8	n e	8	33	20	--------	10 p. m.	.20	3
100	Nim.	100	Nim.	100	St.	n e	8	n	6	n	2	25	19	--------	--------	------	------
100	St.	100	Nim.	00	--------	n w	6	w	8	w	8	27	14	10 a. m.	4 p. m.	.05	1
100	St.	90	St.	100	Nim.	w	4	w	12	w	3	24	1	Snowy.	--------	------	------
50	Cu.	00	--------	100	St.	n	6	w	8	w	1	16	6	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	769	350	--------	--------	2.66	19.56
80	-------	80	-------	72	--------	----	---	----	----	----	----	25°.0	11.°3	--------	--------	------	------
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Meteorological Observations for

Day of Month.	Thermometer, in open air.				Relative Humidity, or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	12	18	10	13⅛	100	100	100	.075	.098	.068	29.063	29.105	29.148	29.105
2	4	4	-10	-⅔	100	100	------	.052	.052	------	29.266	29.373	29.491	29.377
3	-11	2	-5	-4⅓	------	100	------	------	.048	------	29.420	29.470	29.383	29.424
4	-15	0	-14	-9⅔	------	100	100	------	.044	.024	29.438	29.291	29.583	29.437
5	0	10	12	7⅓	100	100	61	.044	.068	.051	29.454	29.338	29.306	29.366
6	11	25	23	23	80	87	100	.060	.123	.123	29.157	29.018	29.198	29.124
7	23	32	25	26⅔	100	79	100	.123	.155	.135	29.211	29.173	29.073	29.152
8	29	41	35	35	89	74	90	.148	.218	.191	28.918	28.882	28.903	28.901
9	32	48	42	40⅔	89	63	66	.168	.269	.215	28.916	28.947	29.012	28.958
10	41	49	41	43⅔	74	64	74	.218	.282	.265	29.146	29.145	29.205	29.165
11	40	50	40	43⅓	91	72	48	.235	.308	.169	29.211	29.163	29.082	29.152
12	39	42	40	40⅓	91	91	91	.225	.254	.235	28.992	28.880	28.685	28.852
13	35	36	35	35⅓	53	90	90	.108	.199	.191	28.599	28.775	28.722	28.699
14	32	32	24	29⅓	100	100	100	.181	.181	.129	28.667	28.852	29.032	28.850
15	20	25	19	21⅓	100	100	100	.108	.135	.103	28.972	28.998	29.138	29.036
16	7	14	8	9⅔	100	64	100	.060	.059	.062	29.386	29.480	29.458	29.408
17	20	34	28	27⅛	85	79	77	.096	.170	.130	29.113	28.970	29.037	29.040
18	29	44	37	36⅔	89	52	81	.148	.210	.195	29.038	28.858	28.870	28.922
19	34	24	12	23⅓	100	87	100	.196	.117	.075	28.674	28.732	29.035	28.854
20	4	15	19	12⅔	100	82	85	.052	.074	.091	29.250	29.255	29.113	29.206
21	25	29	22	25⅛	87	78	86	.123	.136	.106	28.645	28.805	29.067	28.839
22	18	33	36	29	84	61	61	.087	.136	.160	29.113	28.893	28.957	28.988
23	25	28	19	24	87	88	100	.123	.142	.103	29.298	29.450	29.468	29.405
24	23	44	40	39	73	84	91	.100	.262	.235	29.331	29.080	28.795	29.069
25	41	19	10	35⅔	91	------	100	.244	------	.068	28.404	28.602	28.792	28.599
26	9	15	12	12	------	82	80	------	.074	.063	29.100	29.285	29.358	29.248
27	5	18	13	12	100	68	81	.055	.075	.067	29.412	29.385	29.385	29.394
28	7	18	10	11⅔	77	53	100	.048	.064	.068	29.396	29.380	29.445	29.407
29	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
30	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
31	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	22°.27	90	87	88	.123	.146	.128	--------	--------	--------	29.106
Average					86			.132			--------			

the Month of February, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent. of Cloud.	Kind.	Per Cent. of Cloud.	Kind.	Per Cent. of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
100	St.	100	St.	100	St.	s	1	s w	12	s w	16	20	4	--------	--------	------	------
20	Cu.	00	--------	00	--------	w	12	w	12	w	1	– 5	–15	--------	--------	------	------
30	St.	00	--------	100	St.	n	4	n w	8	n w	4	– 4	–17	--------	--------	------	------
20	Cu.	00	--------	00	--------	n	2	n w	6	n	1	– 4	–18	--------	--------	------	------
100	St.	100	St.	100	St.	s w	12	n w	20	s	12	14	– 6	--------	--------	------	------
100	St.	100	St.	100	St.	s	12	s w	8	s w	3	26	11	8 a. m.	12 m.	.20	2
100	St.	100	St.	00	--------	----	0	s	7	s	12	33	23	--------	--------	------	------
00	--------	00	--------	00	--------	s w	12	s w	12	s w	8	42	29	--------	--------	------	------
60	St.	80	St.	30	St.	s	5	s	8	s	8	49	32	--------	--------	------	------
90	St.	100	St.	100	St.	s e	8	s e	8	s e	8	50	40	--------	--------	------	------
95	St.	50	St.	100	St.	s e	12	s	4	w	2	50	38	--------	--------	------	------
100	St.	100	St.	100	St.	e	2	s e	2	s e	1	52	30	--------	--------	------	------
100	St.	100	Nim.	100	Nim.	w	8	w	8	s	6	36	32	8 a. m.	--------	------	------
100	Nim.	100	Nim.	100	Nim.	e	1	n e	12	n e	6	36	20	--------	10 p. m.	.45	2
100	St.	100	Nim.	100	St.	n e	4	w	16	w	20	27	7	--------	--------	------	------
20	St.	60	Cu.	00	--------	s w	8	w	16	s w	1	20	5	--------	--------	------	------
100	Nim.	100	St.	30	Cu.	s w	16	s w	20	w	4	35	20	--------	--------	------	------
100	St.	100	St.	100	St.	s	8	s	16	s w	12	44	27	3 p. m.	--------	------	------
100	Nim.	100	Nim.	30	St.	s w	6	n w	20	n w	16	34	4	--------	6 p. m.	.25	1
00	--------	10	St.	100	St.	n w	12	w	8	s	12	25	4	In night.	--------	.20	2
100	St.	100	St.	100	St.	s	20	w	20	w	4	32	15	--------	--------	------	------
30	Cir. St.	10	Cir.	60	St.	s	12	s	20	s w	12	36	19	--------	--------	------	------
100	St.	00	--------	00	--------	n	8	s w	4	----	0	29	18	--------	--------	------	------
30	Cir. St.	100	St.	100	Nim.	s e	6	s	16	s w	12	44	24	9 p. m.	--------	------	------
100	Nim.	100	St.	100	St.	s w	16	s w	12	s w	8	45	7	--------	9 a. m.	.25	------
10	Cir. St.	20	Cu.	60	--------	n w	12	n w	16	w	4	15	5	--------	--------	------	------
20	Cir. Cu.	30	Cir. St.	20	St.	n e	6	n e	6	e	8	18	5	--------	--------	------	------
40	St.	90	St.	70	St.	e	8	n e	12	n e	8	19	5	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	---	----	----	------	------	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	1.35	7
67	--------	66	--------	62	--------	----	----	----	----	----	----	29.0	12.8	--------	--------	------	------

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Meteorological Observations for

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 P. M.	2 P. M.	9 P. M.	Mean.
1........	6	16	10	10⅔	100	66	79	.057	.067	.057	29.496	29.486	29.433	29.432
2........	5	22	15	14	100	58	65	.055	.082	.063	29.466	29.391	29.386	29.414
3........	12	29	27	22⅔	100	67	76	.075	.125	.123	29.386	29,368	29.358	29.371
4........	19	34	23	25⅓	100	52	86	.103	.131	.111	29.393	29.334	29.315	29.347
5........	16	36	26	26	100	45	75	.090	.134	.117	29.256	29.205	29,221	29.227
6........	18	39	26	27⅔	100	25	75	.098	.120	.117	29.245	29.250	29.222	29.239
7........	23	41	30	31	100	33	100	.123	.152	.167	29.163	28.985	28.915	29,021
8........	32	32	26	30	100	79	100	,181	.155	.141	28.728	28.782	28.900	28.803
9........	26	27	24	25⅔	88	88	87	.129	.135	.117	28.958	29.012	29.108	29.036
10........	21	32	22	25	100	59	86	.113	.129	.106	29.232	29.250	29.210	29.231
11........	25	38	32	21⅔	87	54	100	.123	.164	.181	29.148	28.923	28.808	28.993
12........	24	40	32	34⅔	100	65	79	,181	.196	.155	28,514	28.524	28.607	28.548
13........	30	34	24	29⅓	100	79	100	.167	.170	.129	28.567	28.529	28.707	28.534
14........	23	31	27	27	100	89	88	.123	.162	.135	28.913	28.911	28.940	28.923
15........	27	45	31	34⅓	100	68	89	.147	.247	.162	28.905	28.877	28.907	28.926
16........	30	36	34	33⅓	89	90	79	.155	.199	.170	29.239	29.273	29.291	29.368
17........	30	49	38	39	100	84	72	.167	.255	.190	29.314	29.255	29.173	29.244
18........	34	47	35	38⅔	90	70	90	.183	,270	.191	29.062	28.917	28,982	28.990
19........	37	64	47	49⅓	100	63	100	.221	.503	.323	28.813	28.722	28.700	28.745
20........	41	40	40	40⅓	100	100	100	.257	.248	.248	28.637	28.534	28.205	28.459
21........	36	33	31	33⅓	90	100	100	.199	.188	.174	28.210	28.244	28.454	28.303
22........	27	33	27	29	88	89	76	.135	.175	.123	28.682	28.777	29.008	28.822
23........	18	33	28	26⅓	68	51	77	.095	.123	.130	29.148	29.260	29.185	29,198
24........	27	50	43	40	76	32	59	.123	.229	.212	29.192	28.963	28.843	28.999
25........	38	50	39	42⅓	91	26	46	.216	.216	.160	28.915	29.018	29.072	29.002
26........	34	46	28	36	70	26	88	.157	.179	.142	29.081	29.109	29.246	29.145
27........	21	34	26	27	86	70	75	.101	.249	.117	29.316	29.283	29.353	29.317
28........	25	38	31	31⅓	87	38	100	.123	.138	.174	29.507	29.401	29.228	29.379
29........	33	49	38	40	89	64	81	.175	.289	.203	29.012	29.025	29.067	29.045
30........	32	34	33	33	100	100	100	.181	.196	.188	28.971	28.905	28.865	28.914
31........	33	45	33	37	100	84	89	.188	.273	.175	28.550	28.399	28.407	28.452
Sums......	......	......	.....	......	......	......	......	......	......	......	....	....	....	....
Means	......	......	......	31,33	90	65	84	.143	.190	.155	....	....	....	29.013
Average......................						80			.169		....			

the Month of March, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain, or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
60	Cu.	10	Cir.	20	St.	n e	8	n w	6	n	12	17	5	--------	--------	------	------
00	--------	10	Cu.	20	St.	w	8	n w	12	n w	5	22	5	--------	--------	------	------
30	St.	70	Cu.	100	St.	n w	8	w	8	w	6	31	12	--------	--------	------	------
10	St.	00	--------	00	--------	n w	4	n	6	----	0	34	16	--------	--------	------	------
00	--------	10	St.	00	--------	e	1	s e	2	----	0	36	16	--------	--------	------	------
10	St.	5	Cu.	00	--------	----	0	w	1	----	0	39	18	--------	--------	------	------
00	--------	40	Cu,	100	St.	w	1	s w	8	----	0	41	23	--------	--------	------	------
100	Nim,	70	Nim.	100	Nim.	s w	8	w	16	w	12	34	23	--------	--------	.10	1½
100	St.	100	Nim.	100	St.	w	6	n e	5	n e	1	31	20	Snow	squalls	------	------
70	St.	00	--------	00	--------	n w	6	w	8	w	4	33	20	--------	--------	------	------
80	Cir St.	100	Cir St.	100	Nim.	s w	16	s	16	n e	1	41	25	8 p. m.	--------	------	------
100	Nim.	70	Cir St.	60	St.	s	1	n w	4	----	0	43	30	--------	9 a. m.	.30	4
100	Nim.	100	Cir St.	100	St.	w	4	w	12	w	12	37	17	--------	--------	------	------
100	St.	100	St.	90	St.	e	4	e	8	e	1	31	23	--------	--------	------	------
100	Fog,	100	St.	100	St.	e	1	n e	3	----	0	46	28	5 p. m.	7 p. m.	.10	------
100	St.	100	St.	00	--------	----	0	s w	4	s	2	38	26	--------	--------	------	------
60	Cir Cu.	70	Cu St.	100	St.	e	1	e	4	e	2	49	30	--------	--------	------	------
100	Nim.	30	St.	20	Cu.	e	2	e	5	e	4	51	34	1 a. m.	7 a. m.	.50	------
100	Nim.	Sm	oky.	20	St.	s e	3	s	6	----	0	65	37	--------	--------	------	------
80	Cu St.	100	St.	100	Nim.	s e	2	e	12	n e	4	46	36	6 p. m.	--------	------	------
100	Nim.	100	Nim.	100	Nim.	s w	16	s w	12	w	16	37	27	--------	--------	1.05	2
100	Nim.	100	Nim.	100	St.	w	16	n	20	n w	12	35	18	Snow	squalls	------	------
00	--------	00	--------	00	--------	n	8	w	8	w	3	34	18	--------	--------	------	------
100	St.	70	Cir St.	30	St.	s	5	s	12	s	8	51	27	--------	--------	------	------
10	St.	30	Cir St.	20	St.	w	12	w	20	w	16	50	30	--------	--------	------	------
30	Cu.	10	Cu.	00	--------	w	12	w	20	n e	8	46	21	--------	--------	------	------
90	Cir. St.	20	Cir St.	00	--------	n e	6	n e	12	e	3	34	21	--------	--------	------	------
20	Cir.	90	Cir Cu.	100	Nim.	e	8	e	8	e	8	39	25	8 p. m.	--------	------	------
100	Nim.	100	St.	80	St.	n e	1	s w	6	----	0	50	32	--------	8 a. m.	.06	------
100	Nim.	100	Nim.	100	Nim.	n e	12	n e	8	n e	4	34	32	5 a. m.	--------	------	------
100	Nim.	100	Nim,	10	St.	n e	3	s w	16	s w	8	45	32	--------	3 p. m.	.52	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	2.63	7.50
66	--------	60	--------	54	--------	----	----	----	----	----	----	39°.35	13°.4	--------	--------	------	------
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Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	32	34	25	30⅓	100	100	87	.181	.196	.123	28.365	28.728	29.000	28.697
2	24	32	22	26	87	79	72	.117	.155	.094	29.138	29.176	29.241	29.185
3	20	33	25	26	100	79	100	.108	.162	.135	29.327	29.283	29.291	29.300
4	23	29	24	25⅔	73	78	87	.100	.136	.117	29.306	29.291	29.321	29.306
5	23	39	31	31	86	46	89	.111	.160	.150	29.338	29.265	29.198	29.267
6	33	27	27	29	79	88	88	.162	.135	.135	28.898	28.837	28.950	28.895
7	28	41	32	33⅔	77	49	59	.130	.179	.129	28.968	29.052	29.203	29.308
8	29	53	36	39⅓	100	36	61	.160	.270	.160	29.301	29.276	29.331	29.303
9	36	61	45	47⅓	61	45	61	.160	.403	.234	29.319	29.263	29.248	29.277
10	42	47	35	41⅓	100	70	90	.241	.270	.191	29.238	29.313	29.365	29.305
11	40	56	45	47	82	51	84	.222	.343	.273	29.306	29.233	29.193	29.244
12	45	58	51	51⅓	100	82	86	.300	.442	.348	29.118	29.135	29.213	29.189
13	47	60	49	52	100	71	85	.323	.451	.321	29.276	29.291	29.261	29.276
14	51	75	62	62⅔	86	52	41	.348	.719	.409	29.243	29.085	29.085	29.138
15	59	78	65	67⅓	65	50	49	.420	.796	.484	29.198	29,087	29.095	29.127
16	61	79	59	66⅓	100	54	88	.537	.841	.473	29.170	29.085	29.265	29.173
17	62	76	56	64⅔	72	34	100	.489	.680	.449	29.243	29.270	29.325	29.279
18	59	77	57	64⅓	82	41	69	.460	.724	.399	29.396	29.370	29.385	29.384
19	53	74	58	61⅔	93	43	76	.390	.664	.429	29.451	29.420	29.385	29.412
20	54	71	56	60⅓	93	41	69	.405	.584	.383	29.361	29.313	29.265	29.313
21	55	77	60	64	74	35	71	.380	.710	.451	29.246	29.220	29.215	29.227
22	56	78	59	64⅓	87	32	70	.423	.728	.433	29,216	29.145	29.085	29.149
23	61	80	65	68⅔	66	41	63	.457	.820	.524	29.005	28.772	28.785	28.854
24	60	52	41	51	82	79	91	.478	.349	.244	28.892	28.998	29.052	28.981
25	47	64	55	55⅓	100	68	87	.323	.516	.407	29.045	28.965	28.967	28.992
26	53	73	58	61⅛	93	55	88	.390	.677	.456	28.888	28.717	28.685	28.763
27	49	59	46	51⅓	71	28	77	.295	.327	.272	28.811	28.818	28.910	28.846
28	50	68	57	58⅓	79	47	87	.321	.537	.439	29.038	28.988	28.975	29.000
29	54	66	51	57	100	41	65	.338	.478	.308	28.975	28.892	28.915	28.927
30	45	62	44	50⅓	84	66	84	.273	.322	.262	28.873	28.900	28.967	28.913
31	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	50°.18	86	56	77	.301	.459	.308	--------	--------	--------	29.113
Average					73			.356			----------------------------------			

for the Month of April, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
100	Nim.	100	Nim.	100	St.	s w	16	s w	12	s w	16	42	24	4 a. m.	8 p. m.	.15	------
100	Cu.	40	Cu.	00	--------	w	12	w	12	w	4	32	16	--------	--------	------	------
10	St.	50	Cu.	00	--------	n	6	n	8	e	5	35	20	--------	--------	------	------
70	Cu.	70	Cu.	00	--------	n e	8	n	8	----	0	32	20	--------	--------	------	------
10	St.	40	Cir.Cu.	100	St.	e	5	n e	8	n e	8	40	21	--------	--------	------	------
100	Nim.	100	Nim.	100	Nim.	n e	20	n e	28	n e	16	33	26	7 a. m.	10 p. m.	.50	5
100	St.	00	--------	00	--------	n	8	e	1	----	0	43	22	--------	--------	------	------
00	--------	00	--------	00	--------	s	2	s w	1	----	0	53	29	--------	--------	------	------
20	St.	90	Cir. St.	80	St.	s	6	s w	8	----	0	61	36	--------	--------	------	------
100	St.	100	St.	100	Nim.	s	5	n e	6	e	6	53	35	7 p. m.	--------	------	------
100	Nim.	100	St.	100	Nlm.	e	8	e	8	e	6	58	40	--------	8 a. m.	.05	------
100	Nim.	100	St.	100	St.	s e	6	s w	7	w	4	61	45	5 a. m.	8 p. m.	.23	------
100	Fog.	60	Cu.	10	Cu.	----	0	e	6	e	6	61	45	--------	--------	------	------
70	Cir. St.	50	St.	100	St.	s e	8	s e	8	s e	6	71	52	--------	--------	------	-----
70	Cu. St.	40	Cu. St.	80	St.	s e	12	s e	16	s e	12	78	54	--------	--------	------	------
60	Cu.	100	Cu.	20	St,	s e	8	s	16	----	0	79	54	--------	--------	------	------
70	St.	60	Cu.	100	St.	s	8	s	5	----	0	76	52	6 p. m.	10 p. m.	.16	------
30	Cu.	50	Cu.	5	Cu.	s	3	s	4	----	0	77	46	--------	--------	------	------
10	St.	10	Cu.	00	--------	n e	1	e	2	----	0	75	48	--------	--------	------	------
15	Cu.	10	Cu.	00	--------	e	1	e	3	----	0	71	46	--------	--------	------	------
10	St.	30	Cu.	00	--------	----	0	n	1	----	0	78	48	--------	--------	------	------
00	--------	20	Cu.	00	--------	----	0	s w	5	----	0	78	52	--------	--------	------	------
10	St.	50	Cu.	100	Nim.	w	8	s w	16	s w	12	80	56	8 p. m.	12 p. m.	.32	------
100	St.	100	St.	100	St.	w	8	n	8	n e	1	63	42	--------	--------	------	------
100	St.	100	St.	60	St.	e	4	s	12	s e	4	66	47	--------	--------	------	------
80	Cir. St.	100	Cu. St.	100	Nim.	s	6	s e	8	s e	7	75	45	4 p. m.	10 p. m.	.58	------
00	--------	20	Cu.	00	--------	s w	2	w	5	----	0	60	44	--------	--------	------	------
90	St.	100	Cu. St.	80	St.	----	0	e	1	e	1	70	45	--------	--------	------	------
20	Cir. St.	60	Cu. St.	10	St.	e	1	e	4	n e	4	66	42	--------	--------	------	------
100	St.	100	Cu. St.	100	St.	n e	8	n e	12	n	2	55	44	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	1.99	5
58	--------	62	--------	52	--------	----	----	----	----	----	----	60°.7	38°.6	--------	--------	------	------
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Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	46	59	47	50⅔	92	54	85	.298	.393	.297	29.005	29.065	29.098	29.056
2	53	68	52	57⅔	67	30	66	.387	.483	.322	29.166	29.178	29.191	29.176
3	49	64	60	57⅔	85	53	65	.321	.476	.438	29.188	29.150	29.092	29.143
4	56	60	50	55⅓	94	88	79	.436	.491	.321	28.933	28.853	28.900	28.895
5	44	60	51	51⅔	92	55	72	.275	.411	.321	28.995	28.998	28.998	28.997
6	48	70	53	57	85	53	86	.309	.599	.376	29.015	28.988	29.030	29.011
7	41	63	46	50	74	46	77	.218	.429	.272	29.111	29.060	28.985	29.052
8	54	68	56	59⅓	------	38	75	------	.510	.396	29.154	29.057	29.007	29.073
9	52	55	51	52⅔	93	68	79	.375	.367	.335	28.998	28.912	28.922	28.954
10	51	52	48	50⅓	100	93	93	.374	.375	.322	28.738	28.867	28.962	28.856
11	48	69	61	59⅛	100	61	88	.335	.601	.510	28.958	28.942	28.982	28.961
12	57	76	66	66⅓	94	64	74	.452	.789	.572	29.028	28.967	28.907	28.967
13	55	74	62	63⅔	93	72	88	.420	.758	.529	28.828	28.835	28.855	28.839
14	61	72	53	62	94	62	93	.505	.677	.290	28.851	28.686	28.736	28.759
15	44	62	43	49⅔	100	67	100	.289	.476	.278	28.795	28.892	28.982	28.893
16	44	50	44	46	100	72	84	.289	.308	.241	29.276	29.296	29.335	29.302
17	40	61	48	49⅔	91	71	93	.235	.470	.322	29.404	29.368	29.383	29.383
18	53	67	55	58⅓	73	69	100	.376	.581	.432	29.266	29.221	29.183	29.223
19	64	73	60	65⅔	73	76	88	.529	.744	.491	29.183	29.087	29.141	29.137
20	60	68	53	60⅛	71	47	80	.451	.537	.363	29.161	29.150	29.145	29.152
21	53	75	68	65⅓	80	44	70	.363	.692	.604	29.146	29.017	28.987	29.050
22	66	83	64	71	89	67	83	.612	1.019	.556	29.020	29.007	29.035	29.021
23	68	77	59	68	79	73	88	.604	.846	.473	29.077	29.057	29.045	29.060
24	56	71	55	60⅔	80	71	87	.423	.678	.407	29.032	28.970	29.025	29.009
25	43	60	47	50	92	65	77	.265	.438	.283	29.130	29.155	29.168	29.151
26	46	64	59	56⅓	77	78	94	.272	.543	.487	29.130	29.052	28.835	29.006
27	57	65	49	57	87	78	93	.439	.564	.335	28.807	28.852	28.930	28.864
28	50	72	58	60	86	76	88	.334	.717	.456	29.038	29.002	28.977	29.006
29	63	72	62	65⅔	83	80	94	.536	.731	.543	28.962	28.937	28.947	28.949
30	56	72	58	62	87	76	94	.423	.717	.469	29.010	29.012	29.007	29.010
31	52	72	58	60⅔	93	67	82	.375	.691	.442	20.143	29.158	29.133	29.145
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	58°.06	87	65	84	.382	.584	.406	--------	--------	--------	29.036
Average					79			.457			--------------------------------			

for the Month of May, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or of Melted Snow.	Depth of Snow. Inches.
100	St.	100	Cu. St.	80	St.	n e	2	n e	4	----	0	62	38	Showers	--------	.05	------
00	--------	20	Cu.	00	--------	w	3	w	3	----	0	68	42	--------	--------	------	------
80	Cu. St.	100	Cu. St.	100	St.	w	3	w	2	----	0	71	49	--------	--------	------	------
100	Nim.	100	Nim.	00	--------	s w	1	s w	2	w	1	67	39	6 a. m.	5 p. m.	.30	------
40	Cir.St.	50	Cu.	00	--------	w	1	w	1	w	1	64	39	--------	--------	------	------
60	St.	20	Cu.	30	Cu. St.	w	1	w	1	n w	4	70	40	--------	--------	------	------
20	Cu.	10	Cu.	00	--------	n e	5	n e.	7	----	0	63	40	--------	--------	------	------
00	--------	80	Cu. St.	100	St.	n e	2	e	4	----	0	70	52	--------	--------	------	------
100	Nim.	100	Nim.	100	Nim.	----	0	s e	8	e	10	56	50	5 a. m.	--------	------	------
100	Nim.	100	Nim.	100	St.	e	1	n	5	e	1	54	45	--------	9 a. m.	.90	------
100	St.	50	Cu. St.	100	St.	s	1	s w	2	----	0	71	45	--------	--------	------	------
00	--------	70	Cu. St.	100	Nim.	e	1	e	2	e	3	78	52	9 p. m.	9.30p.m.	.05	------
90	St.	60	Cu.	70	St.	----	0	s	1	----	0	75	55	--------	--------	------	------
70	Cir.Cu.	100	Cu. St.	100	Nim.	s w	1	e	1	n	1	74	44	3 p. m.	--------	------	------
100	Nim.	50	Cu.	100	St.	n	2	s w	1	----	0	62	36	--------	6 p. m.	1.22	------
00	--------	90	Cu.	00	--------	n w	4	w	5	----	0	52	34	--------	--------	------	------
30	St.	30	Cu.	00	--------	w	1	s w	1	----	0	64	42	--------	--------	------	------
10	Cir.Cu.	60	Cu.	00	--------	s	1	----	0	----	0	68	44	--------	--------	------	------
00	--------	30	Cu.	00	--------	----	0	w	1	----	0	73	48	--------	--------	------	------
30	Cu.	00	--------	00	--------	n	1	n	1	s w	1	77	46	--------	--------	------	------
20	St.	20	Cir. St.	00	--------	s	1	s w	1	s w	1	77	53	--------	--------	------	------
30	Cir.Cu.	10	Cir.Cu.	00	--------	n	1	s	1	----	0	83	58	In night.	--------	.05	------
20	Cu. St.	70	Cu. St.	00	--------	w	1	n	2	----	0	77	47	--------	--------	------	------
00	Hazy.	40	Cu. St.	100	St.	----	0	n	2	n w	6	71	37	--------	--------	------	------
00	--------	40	Cu.	00	Smoky	n	10	n	5	----	0	61	37	--------	--------	------	------
00	Smoky	100	St.	100	Nim.	----	0	w	2	w	1	64	46	7 p. m.	11 p. m.	.10	------
100	Cu. St.	40	Cu.	00	--------	n w	10	w	7	----	0	66	40	--------	--------	------	------
00	--------	00	--------	00	--------	----	0	w	8	w	4	72	51	--------	--------	------	------
40	Cir. St.	80	Cu. St.	00	--------	s w	12	s w	20	----	0	74	51	--------	--------	------	------
00	Hazy.	00	--------	100	St.	e	2	n	1	----	0	73	40	--------	--------	------	------
00	--------	00	--------	00	--------	n	3	n	2	----	0	74	52	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	2.67	------
44	--------	52	--------	43	--------	----	----	----	----	----	----	67°.9	45°	--------	--------	------	------
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Meteorological Observations

Day of Month.	Thermometer, in open air.				Relative Humidity, or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	60	73	67	66⅔	88	76	89	.491	.744	.635	29.125	29.067	28.997	29.063
2	69	72	59	66⅔	90	71	70	.682	.704	.433	28.870	28.930	29.060	28.955
3	52	64	47	54⅓	66	34	85	.322	.422	.297	29.266	29.281	29.251	29.266
4	59	71	55	61⅔	48	33	62	.380	.557	.354	29.238	29.130	29.092	29.150
5	58	69	56	61	64	56	87	.403	.588	.423	28.995	29.025	29.067	29.029
6	52	74	63	63	93	40	78	.375	.650	.522	29.135	29.067	29.007	29.070
7	62	70	50	61	83	44	32	.516	.572	.316	29.042	29.122	29.203	29.122
8	50	76	56	59⅓	86	38	81	.334	.596	.410	29.281	29.223	29.185	29.230
9	57	75	62	65	81	60	94	.426	.775	.543	29.048	28.932	28.917	28.966
10	58	65	55	59⅛	82	94	100	.442	.604	.433	28.952	29.002	29.012	28.989
11	58	71	64	64⅓	94	85	68	.469	.718	.516	29.100	29.090	29.088	29.093
12	62	83	71	72	51	79	85	.436	1.060	.718	29.130	29.077	29.072	29.093
13	72	75	69	72	80	81	100	.731	.813	.708	29.027	28.950	28.960	28.979
14	71	86	73	76⅔	95	58	85	.745	1.092	.772	28.962	28.950	28.937	28.950
15	75	89	70	78	86	44	95	.827	1.147	.720	28.932	28.823	28.834	28.863
16	70	83	74	75⅔	95	60	81	.720	.992	.785	28.842	28.842	28.799	28.828
17	65	74	52	63⅔	89	47	73	.591	.677	.336	28.720	28.790	29.057	28.856
18	53	67	54	58	67	33	61	.337	.474	.338	29.166	29.176	29.191	29.178
19	52	72	57	60⅓	79	76	75	.349	.717	.413	29.256	29.251	29.216	29.241
20	60	77	68	68⅓	82	31	65	.478	.697	.591	29.231	29.142	29.127	29.167
21	66	80	65	71⅛	89	44	84	.612	.833	.577	29.148	29.120	29.125	29.131
22	65	74	62	67	89	68	88	.591	.745	.529	29.093	28.972	28.987	29.017
23	60	76	62	66	88	52	94	.491	.748	.543	28.962	28.935	28.927	28.941
24	60	66	62	62⅔	100	79	100	.518	.586	.556	28.922	28.922	28.905	28.916
25	61	72	62	65	94	71	83	.523	.704	.516	28.978	28.977	29.025	28.993
26	60	74	61	65	88	68	94	.491	.745	.523	29.118	29.115	29.125	29.119
27	64	74	64	67⅓	89	55	78	.570	.704	.543	29.146	29.143	29.151	29.147
28	59	77	60	65⅓	82	38	88	.460	.724	.658	29.226	29.213	29.218	29.219
29	59	81	63	67⅔	82	32	83	.460	.812	.536	29.223	29.188	29.165	29.192
30	64	80	62	68⅔	73	34	77	.529	.792	.502	29.258	29.278	29.263	29.266
31	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Sums	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Means	------	------	------	65°.72	82	56	81	.510	.733	.525	------	------	------	29.068
Average					73			.589			------			

for the Month of June, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
00	--------	100	St.	100	St.	----	0	s	8	n e	2	74	61	--------	--------	------	------
100	St.	40	Cu. St.	100	St.	s w	3	w	3	----	0	74	42	--------	--------	------	------
00	--------	60	Cu. St.	00	--------	s w	1	n	8	n	2	66	42	--------	--------	------	------
10	St.	40	Cu.	00	--------	s w	8	w	12	----	0	71	43	--------	--------	------	------
100	Cu. St.	60	Cu.	00	--------	s w	8	s w	12	----	0	71	44	8 a. m.	10 a. m.	.05	------
100	St.	30	Cu.	30	St.	e	2	s w	8	s	6	74	52	8 p. m.	11 p. m.	.30	------
10	St.	10	Cu.	00	--------	w	8	s w	8	----	0	72	40	--------	--------	------	------
00	--------	00	--------	30	Cir.Cu.	n e	3	se	2	se	1	72	50	--------	--------	------	------
100	Cu. St.	60	Cu. St.	100	Nim.	se	4	s	8	se	2	77	55	8 p. m.	10 p. m.	.15	------
5	St.	100	Cu. St.	10	St.	n w	8	n	4	----	0	67	47	--------	--------	------	------
30	Cir.Cu.	100	Cu. St.	00	--------	----	0	se	2	se	4	73	57	--------	--------	------	------
20	Cir. St.	10	Cu.	00	--------	se	5	s	8	s	8	83	60	--------	--------	------	------
70	Cir.Cu.	100	Cu. St.	30	Cir.	s	6	s	6	----	0	76	65	6 p. m.	7 p. m.	.10	------
90	Cu. St.	80	Cu. St.	00	--------	s w	8	w	4	----	0	89	67	--------	--------	------	------
30	Cir.	70	Cu.	100	Nim.	----	0	s w	12	----	0	90	69	6 p. m.	8 p. m.	.10	------
100	Nim.	40	Cu.	100	St.	w	2	n w	4	----	0	83	62	11 p. m.	12 p. m.	.43	------
80	Cu. St.	80	Cu.	00	--------	w	12	w	20	n	6	75	41	--------	--------	------	------
00	--------	80	Cu.	00	--------	n	4	n	5	w	3	69	42	--------	--------	------	------
10	St.	10	Cu.	00	--------	w	2	s	4	----	0	75	50	--------	--------	------	------
90	St.	10	Cir.Cu.	100	St.	s	1	s	4	----	0	77	60	--------	--------	------	------
30	Cu.	70	Cu. St.	10	St.	s w	1	s w	4	s w	2	81	58	--------	--------	------	------
100	St.	100	St.	100	St.	se	4	se	8	se	3	78	54	--------	--------	------	------
100	Cu. St.	70	Cu. St.	100	Cu. St.	----	0	n e	1	e	1	77	58	5 p. m.	--------	------	------
80	Nim.	100	Nim.	100	Nim.	n	3	n	2	n	3	79	58	--------	--------	------	------
100	Nim.	100	Nim.	00	--------	w	5	n w	8	n w	2	72	54	--------	4 p. m.	.79	------
100	Cu. St.	60	Cir.Cu.	10	St.	n w	8	w	4	----	0	75	52	--------	--------	------	------
40	Cu. St.	90	Cu. St.	00	--------	n w	1	s	2	----	0	78	48	--------	--------	------	------
10	Cir.	10	Cir. St.	00	--------	n e	4	e	4	----	0	78	55	--------	--------	------	------
00	--------	00	--------	00	--------	n	5	n	4	----	0	82	54	--------	--------	------	------
00	--------	00	--------	00	--------	n	1	e	3	----	0	81	58	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	1.92	------
50	--------	56	--------	34	--------	----	----	----	----	----	----	76°.3	53.°3	--------	--------	------	------
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Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	58	78	64	66⅔	82	39	68	.442	.755	.516	29.291	29.253	29.235	29.260
2	57	82	62	67	87	36	83	.439	.861	.516	29.283	29.230	29.213	29.242
3	63	85	67	71⅔	83	41	60	.536	.985	.554	29.261	29.224	29.208	29.231
4	72	89	71	77⅓	67	32	75	.691	1.092	.691	29.255	29.221	29.197	29.224
5	70	91	74	78⅓	70	34	68	.652	1.180	.745	29.253	29.226	29.192	29.224
6	74	92	74	80	63	40	72	.731	1.253	.758	29.228	29.178	29.127	29.178
7	74	90	67	77	81	86	79	.785	1.149	.608	29.124	29.139	29.232	29.165
8	62	82	64	69⅓	77	27	63	.502	.820	.503	29.260	29.240	29.198	29.233
9	63	75	64	67⅓	83	56	83	.536	.733	.556	29.155	29.090	29.082	29.109
10	63	84	67	71⅓	89	36	64	.549	.947	.568	29.092	29.059	29.060	29.070
11	71	77	62	70	58	49	72	.638	.764	.489	29.127	29.117	29.087	29.110
12	64	81	66	70⅓	58	35	73	.489	.826	.572	29.092	29.022	28.982	29.025
13	62	79	66	69	83	54	89	.516	.841	.612	28.922	28.809	28.850	28.860
14	60	65	60	61⅔	88	78	82	.491	.564	.478	28.915	28.972	29.032	28.973
15	61	81	60	67⅓	77	35	77	.483	.826	.464	29.018	28.992	28.952	28.987
16	58	81	67	68⅔	88	48	60	.456	.880	.554	28.988	28.950	28.987	28.975
17	61	72	60	64⅓	88	54	88	.510	.650	.491	29.027	29.037	29.082	29.049
18	63	71	58	64	77	53	76	.502	.624	.429	29.118	29.085	29.035	29.079
19	58	79	66	67⅔	82	30	73	.442	.746	.572	29.003	28.942	28.922	28.956
20	61	73	59	64⅓	88	63	88	.510	.704	.473	28.955	28.917	28.902	28.925
21	55	80	69	68	93	37	61	.420	.806	.601	28.900	28.862	28.915	28.892
22	55	79	63	65⅔	81	30	62	.394	.746	.482	29.095	29.102	29.117	29.105
23	58	84	65	69	82	31	63	.442	.906	.524	29.256	29.242	29.210	29.236
24	65	83	73	73⅔	89	30	46	.591	.869	.650	29.206	29.152	29.050	29.136
25	74	92	75	80⅓	63	32	64	.731	1.212	.759	28.985	28.906	28.944	28.945
26	67	70	66	67⅔	89	90	95	.635	.706	.626	28.915	28.930	28.910	28.918
27	66	86	66	72⅔	95	39	89	.626	1.037	.612	28.915	28.947	28.957	28.950
28	70	89	74	77⅔	75	38	72	.666	1.119	.758	28.922	28.874	28.877	28.891
29	70	87	69	75⅓	85	39	70	.693	1.050	.628	28.905	28.924	29.017	28.949
30	67	81	70	72⅔	60	52	66	.554	.894	.639	29.080	29.049	29.052	29.060
31	67	88	70	75	79	34	85	.608	1.064	.693	29.052	29.044	28.974	29.023
Sums	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--------	--------	--------	--------
Means	-----	-----	-----	70°.68	79	44	73	.557	.891	.685	--------	--------	--------	29.064
Average						65			.711		--------			

for the Month of July, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent. of Cloud.	Kind.	Per Cent. of Cloud.	Kind.	Per Cent. of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
00	Hazy.	00	Hazy.	00	Hazy.	n e	1	n e	3	----	0	78	47	--------	--------	------	------
00	Hazy.	00	Hazy.	00	Hazy.	e	1	s e	2	----	0	82	52	--------	--------	------	------
00	Hazy.	70	Cu. St.	00	Hazy.	----	0	w	2	----	0	85	55	--------	--------	------	------
15	Cir.	10	Cir.	00	--------	w	2	w	3	----	0	90	55	--------	--------	------	------
00	Smoky	00	--------	00	--------	w	4	s w	5	----	0	91	62	--------	--------	------	------
00	Smoky	00	Smoky	00	--------	s	5	w	12	----	0	93	70	--------	--------	------	------
00	Smoky	10	Cir.	00	--------	n	4	n	8	n	2	92	54	--------	--------	------	------
00	--------	00	--------	30	Cir. Cu.	n e	7	e	6	----	0	83	56	--------	--------	------	------
30	Cir.Cu.	100	Cu. St.	100	Cu. St.	----	0	n w	3	n	2	82	52	--------	--------	------	------
00	--------	70	Cu. St.	00	Smoky	n e	1	w	6	n	1	85	55	--------	--------	------	------
30	Cu.	100	Cu. St.	100	St.	n	4	n	4	----	0	83	53	--------	--------	------	------
70	St.	60	Cu.	30	Cir. St.	e	2	s	4	s	2	81	57	--------	--------	------	------
80	St.	100	Cu. St.	100	St.	s	6	w	12	n	6	83	58	--------	--------	------	------
20	Cir.Cu.	100	Cu. St.	00	--------	n	8	n e	8	n	8	69	52	--------	--------	------	------
00	--------	40	Cu. St.	10	Cir.Cu.	n	6	n e	8	n e	1	81	57	--------	--------	------	------
00	Smoky	90	Cir.Cu.	100	St.	n e	3	w	8	w	2	86	56	--------	--------	------	------
100	St.	80	Cu. St.	100	Cu. St.	n	4	n	5	n e	2	72	52	--------	--------	------	------
40	Cir.Cu.	40	Cu.	00	--------	n	3	n	3	----	0	71	47	--------	--------	------	------
30	Cir. Cu.	30	Cir.Cu.	100	St.	n e	4	w	6	----	0	79	54	--------	--------	------	------
00	Hazy.	100	Cu. St.	60	--------	n w	1	n	1	----	0	76	46	--------	--------	------	------
00	Smoky	50	Cu.	00	Smoky	n	4	n w	12	n	2	84	45	--------	--------	------	------
00	--------	00	--------	20	St.	n	4	n e	3	----	0	81	47	--------	--------	------	------
00	Smoky	70	Cu.	10	St.	----	0	n	2	----	0	85	57	--------	--------	------	------
00	Smoky	100	Cu. St.	30	St.	s	8	w	4	w	3	86	65	--------	--------	------	------
80	Cu. St.	50	Cu. St.	100	St.	s w	8	s w	12	n e	3	93	65	11 p. m.	--------	------	------
100	Nim.	100	Nim.	00	--------	s	2	w	2	----	0	73	59	--------	3 p. m.	.40	------
60	St.	30	Cu.	20	St.	n w	2	n w	2	----	0	87	65	4 a. m.	5 a. m.	.15	------
70	Cu. St.	15	Cu.	10	St.	s	12	s w	12	s w	3	90	66	4 a. m.	5 a. m.	.10	------
60	Cu. St.	60	Cir. St.	100	St.	s e	6	w	12	n e	2	89	59	--------	--------	------	------
90	Cir. Cu.	100	Cir.Cu.	90	St.	e	4	s e	4	----	0	85	57	--------	--------	------	------
00	--------	10	Cir.	100	St.	s	3	s	4	----	0	88	64	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	.65	------
44	--------	57	--------	44	--------	----	----	----	----	----	----	83.3	55.8	--------	--------	------	------

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Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity, or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 P. M.	2 P. M.	9 P. M.	Mean.
1	75	74	68	72⅓	77	95	79	.800	.826	.631	28.937	28.914	28.957	28.936
2	58	76	54	62⅔	76	31	93	.429	.667	.405	29.062	29.055	29.082	29.066
3	58	78	57	64⅓	70	46	63	.416	.782	.386	29.161	29.122	29.141	29.141
4	54	74	60	62⅔	87	47	77	.391	.677	.464	29.171	29.135	29.122	29.143
5	58	64	56	59⅓	100	78	94	.483	.543	.436	29.128	29.128	29,115	29.124
6	56	77	57	63⅓	100	31	75	.449	.697	.413	29.113	29.077	29.068	29.086
7	56	80	63	66⅓	94	37	72	.436	.806	.509	29.115	29.084	29.117	29.105
8	64	84	71	73	73	37	53	.529	.933	.624	29.236	29.219	29.235	29.230
9	67	86	74	75⅔	69	36	55	.581	.996	.704	29.273	29.271	29.215	29.253
10	70	82	71	74⅓	70	49	80	.652	.915	.705	29.205	29.159	29.100	29.155
11	74	88	68	76⅔	81	31	74	.785	1.050	.617	29.010	29.042	29.065	29.039
12	63	86	74	74⅓	83	30	55	.536	.969	.704	29.075	29.036	29.002	29.038
13	70	81	70	73⅔	70	59	95	.652	.921	.720	28.942	28.877	28.902	28.907
14	65	80	63	69⅓	94	41	62	.604	.820	.482	29.010	29.037	29.095	29.047
15	66	83	71	73⅓	50	27	41	.505	.855	.584	29.161	29.097	29.032	29.097
16	66	85	71	67⅓	95	57	85	.492	1.012	.718	28.833	28.787	28.874	28.831
17	61	79	67	69	?	33	74	?	.760	.595	29.062	29.074	29.170	29.102
18	65	75	61	67	78	44	77	.564	.692	.483	29.183	29.180	29,245	29.203
19	66	73	62	67	50	59	72	.505	.691	.489	29.328	29.278	29.183	29.263
20	64	84	69	72⅓	78	43	81	.543	1.105	.758	29.196	29.069	29.032	29.099
21	67	69	70	68⅔	95	90	100	.695	.682	.733	28.885	29.092	29.010	28.996
22	75	77	70	74	86	86	90	.827	.886	.706	28.882	28.784	28.800	28.822
23	67	69	65	67	95	85	89	.648	.668	.591	28.885	28.955	29.007	28.982
24	63	72	65	66⅔	94	76	94	.563	.718	.604	29.112	29.135	29.168	29.138
25	61	77	63	67	94	65	100	.523	.819	.576	29.233	29.205	29.185	29.208
26	62	85	71	72⅔	94	47	85	.543	1.012	.718	29.201	29.172	29.117	29.163
27	70	90	74	78	90	50	90	.706	1.217	.812	29.133	29.049	29.042	29.075
28	73	84	68	75	85	54	100	.772	1.001	.685	29.037	28.912	28.952	28.967
29	70	74	67	70⅓	95	72	100	.720	.758	.927	28.872	28.824	28.790	28.829
30	65	71	55	63⅔	94	53	81	.604	.624	.394	28.805	28.825	28.892	28.841
31	53	62	49	54⅔	80	32	71	.363	.382	.275	28.993	29.070	29.191	29.085
Sums														
Means				69.30	83	52	79	.577	.822	.595				29.062
Average						71			.665					

for the Month of August, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
20	Cir.	100	Cu St.	70	St.	s	4	s w	2	n	4	80	50	--------	--------	------	------
00	--------	40	Cu.	00	--------	n	12	n w	12	----	0	76	41	--------	--------	------	------
20	Cir St.	20	Cu.	00	--------	n	6	n w	8	----	0	79	44	--------	--------	------	------
00	Smoky.	90	Cu St.	00	--------	n	1	s	5	----	0	77	52	--------	--------	------	------
100	Nim.	100	Cu St.	00	--------	s e	1	e	3	----	0	66	48	1 a. m.	11 a. m.	.50	------
100	Fog.	20	Cir St.	00	--------	e	1	n e	3	----	0	77	47	--------	--------	------	------
00	--------	00	--------	00	--------	e	2	s	4	----	0	80	54	--------	--------	------	------
00	--------	00	--------	00	--------	s	1	s	3	s	7	84	62	--------	--------	------	------
70	Cir. St.	70	Cu St.	00	--------	----	0	s w	2	----	0	88	63	--------	--------	------	------
5	Cir Cu.	90	Cu St.	30	St.	----	0	s w	3	s	2	85	66	--------	--------	------	------
00	--------	80	Cir St.	40	Cir Cu.	s w	4	n w	5	n	3	91	58	--------	--------	------	------
90	Cu St.	40	Cir Cu.	00	--------	e	2	s	6	s	6	88	60	--------	--------	------	------
00	--------	90	Cu St.	100	Nim.	s	8	s w	16	----	0	82	63	8 p. m.	9 p. m.	.01	------
00	Fog.	00	--------	00	--------	n	4	n e	4	n	1	81	50	--------	--------	------	------
00	--------	00	--------	40	Cir Cu.	s e	6	s	8	s	12	83	63	--------	--------	------	------
100	Nim.	30	Cu.	00	--------	s w	12	n w	12	n	2	84	67	5 a. m.	--------	.23	------
100	Cu St.	90	Cu St.	100	Cu St.	n e	1	n	2	----	0	81	64	--------	--------	------	------
100	Cu St.	90	Cu St.	00	--------	e	2	n	2	----	0	83	60	--------	--------	------	------
00	--------	30	Cu St.	100	Cu St.	e	4	e	2	s	3	81	41	--------	--------	------	------
20	Cu.	60	Cu.	100	Cu.	s e	4	s	6	s	7	83	62	--------	--------	------	------
100	Nim.	100	Nim.	100	Nim.	s	6	s	8	s e	1	76	65	5 a. m.	12 p. m.	1.22	------
30	Cu.	100	Cu St.	00	--------	s w	6	s w	8	----	0	79	66	--------	--------	------	------
100	Cu St.	100	Cu St.	100	Cu St.	n	5	n	3	n	3	69	58	--------	--------	------	------
100	Cu St.	100	Cu St.	00	--------	n	1	n	2	n	1	73	54	--------	--------	------	------
100	St.	00	--------	00	--------	----	0	n e	1	----	0	77	55	--------	--------	------	------
00	--------	00	--------	00	--------	e	3	s	2	----	0	85	60	--------	--------	------	------
00	--------	40	Cu.	20	Cu.	s	1	s	2	----	0	91	63	--------	--------	------	------
50	Cu St.	80	Cu St.	100	Nim.	w	1	w	4	s	1	89	65	1 p. m.	9 p. m.	2.20	------
60	St.	100	Nim.	40	St.	s	4	w	2	e	2	83	63	2 p. m.	--------	------	------
100	Nim.	60	Cu St.	00	--------	n w	8	w	12	----	0	72	47	--------	9 a. m.	.53	------
00	--------	20	Cu.	00	--------	w	7	w	12	----	0	66	37	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	4.69	------
47	--------	56	--------	30	--------	----	----	----	----	----	----	80.3	56.4	--------	--------	------	------
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Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	43	66	52	53⅔	100	41	86	.278	.478	.362	29.345	29.391	29.375	29.370
2	53	71	64	62⅔	80	45	63	.363	.597	.503	29.426	29.411	29.421	29.419
3	59	80	67	68⅔	88	37	50	.473	.806	.527	29.416	29.380	29.321	29.372
4	65	81	72	72⅔	78	59	76	.564	.921	.717	29.303	29.260	29.240	29.234
5	70	83	69	74	85	50	90	.693	.951	.682	29.305	29.314	29.295	29.305
6	64	87	69	73⅓	94	52	90	.583	1.105	.682	29.365	29.347	29.325	29.346
7	65	87	68	73⅓	94	49	84	.604	1.091	.644	29.360	29.304	29.315	29.326
8	67	86	70	74⅓	89	55	90	.635	1.078	.706	29.275	29.199	29.210	29.228
9	60	74	71	68⅓	100	81	90	.518	.785	.732	29.196	28.980	28.915	29.030
10	68	71	57	65⅓	100	58	87	.685	.638	.439	28.847	28.947	29.055	28.936
11	48	70	64	60⅔	93	57	68	.322	.612	.516	29.164	29.058	28.945	29.056
12	55	63	48	55⅓	100	52	78	.407	.455	.296	28.965	28.921	28.992	28.959
13	43	66	53	54	83	64	100	.251	.545	.403	29.051	28.953	28.932	28.979
14	50	67	49	55⅓	93	60	93	.348	.554	.335	29.025	29.083	29.130	29.079
15	55	73	66	64⅔	100	72	89	.407	.737	.612	29.151	29,042	28.895	29.029
16	67	68	50	61⅔	95	90	100	.648	.658	.361	28.998	28.887	28.895	28.927
17	57	60	49	55⅓	87	83	93	.426	.478	.335	29.176	29.196	29.298	29.223
18	48	70	59	59	56	66	82	.256	.639	.460	29.406	29.361	29.194	29.320
19	62	62	51	58⅓	94	77	93	.543	.502	.361	28.991	29.133	29.241	29.122
20	44	64	47	51⅔	92	53	92	.275	.476	.310	29.309	29.284	29.291	29.295
21	45	62	50	52⅓	84	77	93	.273	.502	.348	29.309	29.276	29.231	29.272
22	52	65	60	59	79	68	88	.349	.497	.491	29.187	29.043	29.018	29.083
23	60	67	63	63⅓	100	89	100	.518	.635	.576	29.123	29.098	29.206	29.142
24	62	80	70	70⅔	100	59	90	.556	.887	.706	29.316	29.228	29.195	29.246
25	68	82	72	74	84	52	76	.644	.929	.717	29.196	29.109	29.070	29.125
26	66	68	63	65⅔	95	95	100	.626	.671	.576	28.977	29.017	29.047	29.014
27	62	73	63	66	94	81	94	.543	.758	.563	28.922	28.805	28.927	28.885
28	56	58	43	52⅓	87	58	83	.423	.389	.251	29.058	29.078	29.140	29.092
29	42	60	48	50	91	60	70	.254	.425	.282	29.148	29.105	29.010	29.088
30	50	50	39	46⅓	65	72	91	.295	.308	.225	28.826	28.812	29.007	28.882
31	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sums	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Means	-----	-----	-----	62°.07	89	64	86	.459	.670	.477	-----	-----	-----	29.148
Average					80			.535			-----			

for the Month of September, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
30	St.	20	Cir. St.	00	--------	w	1	s w	7	----	0	66	47	--------	--------	------	------
80	St.	80	Cir.Cu.	100	St.	s w	2	s	4	s	3	73	51	--------	--------	------	------
20	Cir.Cu.	20	Cir.	00	--------	s e	7	s	6	s e	5	80	58	--------	--------	------	------
20	Cir.Cu.	100	Cu. St.	70	Cir.Cu.	s e	5	s	8	s e	5	82	64	--------	--------	------	------
100	St.	10	Cir.Cu.	00	--------	s	5	s w	4	----	0	84	58	--------	--------	------	------
50	Cir. St.	30	Cu.	00	--------	s w	2	s	2	----	0	87	61	--------	--------	------	------
00	--------	30	Cu.	00	--------	s	1	s e	7	----	0	87	63	--------	--------	------	------
10	Cir.Cu.	50	Cu.	100	St.	s	4	s w	8	e	2	87	60	--------	--------	------	------
100	Nim.	100	Cu. St.	20	St.	----	0	s	6	s	12	75	62	5 a. m.	11 a. m.	.85	------
100	Cu. St.	30	Cu. St.	00	--------	s w	8	s w	12	s w	2	72	46	1 a. m.	8 a. m.	.95	------
00	--------	20	Cu. St.	30	Cu. St.	s w	2	s	12	s w	16	70	48	1 a. m.	5 a. m.	.22	------
80	Cu. St.	70	Cu. St.	00	--------	n w	6	n w	16	n w	2	63	37	--------	--------	------	------
70	Cu. St.	30	Cu. St.	100	Nim.	s w	7	s w	16	s	4	67	43	3 p. m.	11 p. m.	.80	------
00	--------	10	St.	00	--------	w	4	w	4	w	1	69	48	--------	--------	------	------
10	Cir.Cu.	60	Cir. St.	70	St.	s e	6	s e	6	s w	3	75	55	--------	--------	------	------
100	Cu. St.	80	Cir.Cu.	100	Nim.	s	8	s w	12	s w	12	68	42	12 m.	10 p. m.	.35	------
100	Cu. St.	40	Cu. St.	100	Nim.	n w	8	w	8	----	0	65	47	--------	--------	------	------
00	--------	10	St.	100	St.	w	1	s	8	n e	8	70	53	10 p. m.	--------	------	------
100	Nim.	60	Cu.	10	St.	s w	7	n w	12	n e	3	64	40	--------	9 a. m.	1.22	------
100	St.	40	Cu.	00	--------	w	4	n w	12	----	0	65	38	--------	--------	------	------
100	St.	80	Cu. St.	100	Nim.	w	4	s	1	s e	1	62	38	3 p. m.	10 p. m.	.15	------
80	St.	90	Cu. St.	80	Cu. St.	s	7	s	4	----	0	65	52	--------	--------	------	------
100	St.	100	Cu. St.	100	Nim.	s	1	e	2	s e	1	67	60	3 p. m.	--------	------	------
100	Cu. St.	10	Cu. St.	70	St.	s	5	s	8	s w	5	80	61	--------	4 a. m.	35	------
10	Cu.	20	Cu.	100	St.	s	8	s w	12	s w	1	83	64	--------	--------	------	------
100	Nim.	100	Nim.	70	St.	s w	6	s w	6	----	0	69	62	1 a. m.	--------	------	------
100	Nim.	100	Nim.	100	St.	n e	1	s w	12	s w	12	75	56	--------	6 p. m.	.41	------
100	St.	90	Cu. St.	00	--------	n	4	n w	2	----	0	60	40	--------	--------	------	------
00	--------	----	Hazy.	00	--------	w	3	s w	2	s w	1	60	42	--------	--------	------	------
60	Cu. St.	100	Nim.	90	St.	s w	1	n	5	n w	1	62	35	1 p. m.	4 p. m.	.10	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	5.40	------
61	--------	54	--------	50	--------	----	----	----	----	----	----	71°.7	51°	--------	--------	------	------
		55															

Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent. of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	37	44	37	29⅓	81	52	81	.195	.210	.195	29.174	29.216	29.315	29.235
2	36	56	39	43⅔	80	51	91	.186	.343	.225	29.432	29.432	29.435	29.433
3	50	63	52	55	65	42	66	.295	.429	.322	29.452	29.356	29.276	29.361
4	53	65	51	56⅓	73	63	86	.350	.524	.348	29.108	29.098	29.221	29.142
5	43	67	46	52	100	46	92	.278	.514	.298	29.309	29.303	29.291	29.301
6	48	70	51	56⅓	100	44	93	.335	.572	.361	29.289	29.243	29.235	29.256
7	48	74	55	59	100	68	93	.335	.745	.420	29.261	29.221	29.231	29.238
8	51	74	56	60⅓	93	47	94	.361	.677	.436	29.276	29.240	29.361	29.292
9	50	78	59	62⅓	93	46	82	.348	.782	.460	29.306	29.360	29.255	29.307
10	58	78	60	65⅓	88	43	77	.456	.768	.464	29.313	29.280	29.253	29.282
11	55	78	58	63⅔	87	36	82	.407	.741	.442	29.273	29.258	29.218	29.250
12	55	78	60	64⅓	81	36	88	.398	.741	.491	29.213	29.178	29.135	29.175
13	55	80	67	68	87	37	52	.407	.806	.574	29.115	29.017	28.892	29.008
14	62	60	52	58	94	71	86	.543	.451	.362	28.477	28.270	28.742	28.496
15	52	56	43	50⅛	60	40	67	.309	.316	.225	29.113	29.256	29.423	29.264
16	33	40	36	36⅓	79	56	80	.162	.182	.186	29.644	29.564	29.468	29.559
17	45	59	43	49	76	59	100	.260	.407	.278	29.185	29.111	29.271	29.189
18	41	55	43	46⅓	91	56	100	.244	.340	.278	29.432	29.446	29.441	29.473
19	50	73	60	61	93	46	71	.348	.650	.451	29.469	29.421	29.388	29.426
20	62	63	63	62⅔	67	78	83	.476	.522	.536	29.354	29.248	29.156	29.253
21	38	57	44	46⅛	100	41	100	.229	.333	.289	29.406	29.426	29.411	29.414
22	45	68	49	54	84	42	71	.273	.523	.295	29.324	29.290	29.308	29.307
23	40	69	53	54	91	35	86	.235	.655	.376	29.292	29.228	29.178	29.233
24	59	70	51	60	59	44	93	.407	.572	.361	29.023	29.012	29.117	29.051
25	43	42	38	41	92	66	63	.265	.215	.177	29.331	29.465	29.560	29.455
26	35	42	37	38	80	50	71	.178	.189	.182	29.616	29.561	29.531	29.569
27	36	43	40	39⅔	80	67	91	.186	.225	.235	29.366	29.234	29.141	29.247
28	44	47	39	43⅓	92	70	82	.275	.270	.212	29.013	29.040	29.103	29.052
29	34	52	42	42⅔	79	73	83	.170	.336	.254	29.159	29.235	29.291	29.228
30	40	61	35	45⅛	100	45	100	.248	.483	.204	29.459	29.421	29.396	29.425
31	38	66	45	49⅔	81	41	84	.203	.299	.273	29.414	29.341	29.305	29.352
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	52°.37	85	51	83	.302	.478	.329	--------	--------	--------	29.266
Average					73			.370			--------			

for the Month of October, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or of Melted Snow.	Depth of Snow. Inches.
100	St.	90	Cu. St.	80	St.	w	5	n w	8	w	1	46	32	--------	--------	------	------
00	--------	30	Cir.Cu.	00	--------	s w	5	w	6	----	0	57	36	--------	--------	------	------
30	Cir. St.	30	Cir.St.	20	St.	s w	6	s w	12	s w	8	63	50	--------	--------	------	------
100	St.	100	Cu. St.	00	--------	s w	6	n	3	n	3	69	40	--------	--------	------	------
00	--------	20	Cu.	00	--------	n	2	e	1	----	0	67	42	--------	--------	------	------
100	Fog.	20	Cu.	00	--------	----	0	s	3	----	0	70	47	--------	--------	------	------
10	Cir.Cu.	00	--------	00	--------	s	2	s w	5	----	0	74	48	--------	--------	------	------
00	--------	30	Cir. St.	30	St.	s	4	s w	8	----	0	75	49	--------	--------	------	------
10	St.	50	Cu. St.	00	--------	----	0	s w	5	----	0	78	48	--------	--------	------	------
10	Cir. St.	30	Cu.	00	--------	----	0	s w	5	----	0	78	53	--------	--------	------	------
00	--------	30	Cir.Cu.	00	Hazy.	s	3	s w	6	s w	1	78	54	--------	--------	------	------
20	Cir.	30	Cir.Cu.	10	St.	s w	3	w	12	w	2	78	54	--------	--------	------	------
00	--------	30	Cir.Cu.	10	Cir.	s w	3	s w	8	s	8	80	55	--------	--------	------	------
100	Nim.	100	Nim.	100	Nim.	s e	12	s w	20	w	16	69	49	6 a. m.	10 p. m.	.50	------
80	St.	80	Cu.	90	St.	w	8	n w	16	n	5	57	31	--------	--------	------	------
10	St.	100	St.	100	St.	n	4	n w	1	s e	3	45	33	--------	--------	------	------
70	St.	100	St.	100	St.	s	8	n w	7	n e	4	65	40	--------	--------	------	------
100	St.	80	Cu. St.	00	--------	n e	2	e	2	----	0	55	41	--------	--------	------	------
100	St.	10	St.	00	--------	s e	5	s	6	s w	8	73	50	--------	--------	------	------
80	Cir.Cu.	100	Nim.	100	Nim.	s w	6	s w	16	s w	12	71	38	11 a. m.	10 p. m.	.25	------
00	--------	10	St.	00	--------	n w	6	s w	6	s w	2	57	38	--------	--------	------	------
00	--------	10	Cir.	00	--------	s w	5	s w	8	----	0	68	36	--------	--------	------	------
90	St.	40	Cir.Cu.	30	St.	w	1	s	8	s e	8	69	40	--------	--------	------	------
90	St.	10	Cu.	100	St.	s	8	s w	16	s w	8	71	42	--------	--------	------	------
100	St.	100	St.	100	St.	n w	8	e	6	n	5	43	32	--------	--------	------	------
100	St.	100	Cu. St.	100	Cu. St.	n	4	n e	6	n e	1	43	34	--------	--------	------	------
100	St.	100	St.	100	Nim.	n	5	n	5	n	6	46	36	6 p. m.	--------	------	------
100	Nim.	100	Cu. St.	50	St.	n e	4	e	2	s e	1	47	28	--------	9 a. m.	.20	------
90	St.	100	Cu. St.	10	St.	w	3	n	3	w	1	53	32	--------	--------	------	------
100	Fog.	00	--------	00	--------	----	0	w	4	w	3	62	30	--------	--------	------	------
00	--------	00	--------	00	--------	----	0	w	3	----	0	67	37	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	-----	-----	--------	--------	0.95	------
55	--------	53	--------	38	--------	----	----	----	----	----	----	63°.7	41°.1	--------	--------	------	------

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Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	43	70	53	55⅓	75	28	48	.238	.518	.297	29.244	29.166	29.156	29.189
2	48	68	59	59	63	22	43	.269	.456	.367	29.138	28.992	28.903	29.011
3	46	54	42	47⅓	77	33	37	.272	.287	.183	29.008	28.898	29.393	29.100
4	33	51	45½	43 1-6	79	72	54	.162	.321	.232	29.317	29.108	29.536	29.320
5	46	44	35	41⅔	92	100	90	.310	.289	.191	29.517	29.409	29.346	29.424
6	28	38	25	30⅓	100	45	75	.153	.151	.111	29.182	29.115	29.151	29.149
7	24	35	25	28	87	52	87	.117	.126	.123	29.068	29.080	29.138	29.095
8	26	40	32	32⅔	88	65	66	.129	.196	.129	29.158	29.122	29.108	29.129
9	30	35	32	32⅓	89	90	100	.155	.191	.181	29.098	29.043	28.998	29.046
10	40	45	40	42⅔	100	92	91	.248	.286	.235	29.043	29.100	29.203	29.115
11	32	43	27	34	89	43	76	.168	.186	.123	29.371	29.400	29.436	29.402
12	24	30	27	27	87	68	76	.117	.131	.123	29.322	29.213	29.225	29.253
13	19	39	28	28⅔	85	73	66	.091	.199	.118	29.252	29.231	29.258	29.247
14	27	48	34	36⅓	88	56	90	.135	.256	.183	29.239	29.206	29.274	29.240
15	29	44	29	37⅓	78	37	100	.136	.183	.160	29.392	29,418	29.483	29.431
16	24	45	36	35	87	31	61	.117	.181	.160	29.426	29.248	29.165	29.280
17	41	49	49	46⅓	100	100	100	.257	.348	.348	28.808	28.570	28.367	28.582
18	25	23	23	23⅔	75	60	100	.111	.088	.123	28.507	28.530	28.698	28.578
19	25	34	27	28	87	70	100	.123	.157	.147	29.018	29.090	29.043	29.050
20	32	40	32	34⅔	79	65	89	.155	.196	.168	28.856	28.977	29.048	28.960
21	30	45	29	34⅔	100	53	100	.167	.221	.160	29.135	29.127	29.191	29.151
22	29	42	45	38⅔	100	58	84	.160	.202	.273	29.103	28.970	28.725	28.933
23	53	46	27	42	100	69	76	.403	.258	.123	28.449	28.344	28.594	28.462
24	22	24	22	22⅔	100	87	100	.118	.117	.118	28.878	29.000	29.075	28.984
25	22	24	20	22	100	87	85	.118	.117	.096	29.014	29.020	29.058	29.031
26	22	28	21	23⅓	86	66	86	.106	.118	.101	29.304	29.301	29.103	29.236
27	22	29	31	27⅓	?	67	89	?	.125	.162	29.159	29.209	28.916	29.095
28	23	32	30	28⅓	86	69	?	.111	.142	?	29.121	28.908	28.612	28.880
29	27	27	10	21⅓	88	76	100	.135	.123	.068	28.814	28.892	28.997	28.901
30	5	27	23	18⅓	75	76	86	.048	.123	.111	28.958	28.917	28.928	28.934
31	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	33°.94	88	64	81	.166	.210	.169	--------	--------	--------	29.061
Average					78			.182			--------			

for the Month of November, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning Rain or Snow.	Ending Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow, Inches.
5	St.	20	Cir. St.	30	St.	w	3	s w	4	s w	4	70	43	--------	--------	------	------
20	St.	70	Cir. St.	10	St.	s	4	s	3	s	2	69	44	--------	--------	------	------
20	Cu. St.	20	Cu. St.	00	--------	w	5	w	8	s	4	68	30	--------	--------	------	------
00	--------	50	St.	80	Nim.	w	6	s w	16	s w	16	51	33	--------	--------	------	------
80	St.	75	St.	100	St.	s w	12	n w	16	----	0	46	28	--------	--------	------	------
70	Cu. St.	60	Cu. St.	00	--------	n	1	w	16	----	0	42	16	--------	--------	------	------
10	St.	80	Cu. St.	90	Cu. St.	s w	6	n	12	n w	6	39	24	--------	--------	------	------
90	St.	30	Cu.	00	--------	w	6	w	16	s w	12	40	26	--------	--------	------	------
90	St.	100	Nim.	100	Nim.	s w	7	s	12	s	3	40	30	11 a. m.	--------	------	------
100	Nim.	100	Nim.	100	St.	w	1	w	4	w	8	45	32	--------	3 p. m.	.20	------
100	St.	10	Cu.	00	--------	n	7	n	6	n	1	43	22	--------	--------	------	------
90	St.	100	Cu. St.	100	St.	n	8	n e	12	n e	12	32	18	--------	--------	------	------
10	St.	20	Cu.	00	--------	n w	7	n w	16	n w	1	39	18	--------	--------	------	------
00	--------	00	--------	10	St.	s w	8	w	12	w	4	48	23	--------	--------	------	------
30	St.	20	Cir.	20	St.	w	3	n w	12	n w	1	44	21	--------	--------	------	------
20	St.	40	Cir.	100	St.	e	2	s e	8	e	6	45	24	--------	--------	------	------
100	Nim.	100	Nim.	100	Nim.	s e	4	s e	12	s w	16	49	25	1 a. m.	--------	.70	------
100	Nim.	100	Nim.	100	Nim.	s w	28	s w	32	s w	20	25	22	--------	10 p. m.	.25	1
70	Cu. St.	5	Cu.	100	St.	w	16	w	12	s w	8	34	25	--------	--------	------	------
00	--------	90	Cu.	30	St.	s w	12	w	12	w	3	41	34	--------	--------	------	------
10	St.	90	St.	00	--------	s w	2	s w	2	----	0	47	29	--------	--------	------	------
100	St.	100	St.	100	St.	e	6	e	6	s e	8	53	29	--------	--------	------	------
100	Nim.	100	Cu. St.	100	St.	s	8	s w	24	s w	20	56	22	8 a. m.	12 m.	.10	------
100	Nim.	100	Cu. St.	100	St.	s w	12	w	6	w	6	26	22	--------	--------	------	------
100	St.	100	St.	100	St.	s w	5	s w	12	s w	8	22	17	--------	--------	------	------
100	Nim.	50	Cir. Cu.	100	Nim.	s w	7	s w	6	s w	4	27	16	--------	--------	------	------
100	St.	50	Cu. St.	100	St.	s w	6	s	12	s w	8	41	20	--------	--------	------	------
100	St.	100	St.	100	Nim.	n w	1	s	5	s w	8	37	22	5 p. m.	11 p. m.	.23	2½
90	St.	100	St.	00	--------	n w	2	n	3	----	0	36	3	--------	--------	------	------
70	St.	90	Cu. St.	100	St.	n	1	e	1	----	0	30	5	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	12.45	7.23	--------	--------	1.48	3½
63	--------	66	--------	62	--------	----	----	----	----	----	----	41.5	24.1	--------	--------	------	------
64																	

Meteorological Observations

Day of Month.	Thermometer in Open Air.				Relative Humidity or Per Cent of Saturation.			Pressure of Vapor in Inches.			Barometer, Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	24	19	3	15⅓	87	85	100	.117	.091	.050	28.763	28.802	28.968	28.844
2	3	20	16	13	100	70	83	.050	.084	.078	29.185	29.233	29.308	29.242
3	1	20	16	12⅓	100	85	83	.046	.096	.078	29.409	29.451	29.528	29.463
4	2	18	–2	6	100	68	100	.048	.075	.040	29.657	29.685	29.675	29.672
5	–11	22	14	8⅓	100	58	82	.027	.082	.070	29.564	29.418	29.380	29.454
6	3	32	28	21	100	59	77	.050	.129	.130	29.356	29.373	29.371	29.367
7	15	32	30	25⅔	100	79	85	.086	.155	.096	29.348	29.296	29.288	29.311
8	22	36	36	31⅓	86	61	61	.106	.160	.160	29.271	29.277	29.252	29.267
9	36	40	39	41⅓	80	56	82	.186	.182	.212	29.247	29.203	29.261	29.237
10	35	48	39	40⅔	70	43	82	.165	.230	.212	29.293	29.271	29.271	29.278
11	35	49	37	40⅓	100	?	90	.204	?	.203	29.353	29.328	29.214	29.298
12	41	43	38	40⅔	82	83	100	.231	.251	.229	29.082	28.887	28.817	28.929
13	40	34	28	34	100	70	77	.248	.157	.130	28.599	28.682	28.777	28.686
14	29	30	20	26⅓	100	100	100	.160	.167	.108	28.898	28.637	28.785	28.773
15	5	16	14	11⅔	100	83	100	.055	.078	.082	29.057	29.045	29.067	29.056
16	10	14	9	11	100	64	78	.068	.059	.054	28.998	29.042	29.151	29.064
17	5	22	21	16	100	86	100	.055	.106	.113	29.176	29.080	28.964	29.073
18	21	25	10	18⅔	100	75	100	.113	.111	.068	28.907	28.954	29.054	28.972
19	14	24	16	18	100	74	100	.082	.105	.090	29.160	29.165	29.238	29.188
20	0	22	24	15⅓	100	58	61	.044	.082	.093	29.270	29.113	29.053	29.145
21	28	32	19	19⅔	88	69	85	.142	.142	.091	29.090	29.117	29.278	29.162
22	10	30	6	15⅛	100	78	100	.068	.143	.057	29.365	29.374	29.420	29.386
23	20	28	28	25⅓	100	100	100	.108	.153	.153	29.215	29.125	29.130	29.167
24	27	27	10	21⅓	100	88	100	.147	.135	.068	28.942	29.072	29.248	29.087
25	6	16	13	11⅔	76	66	100	.045	.067	.078	29.331	29.294	29.206	29.277
26	20	26	14	20	85	88	100	.096	.129	.082	28.923	28.913	29.027	28.888
27	4	11	0	5	100	80	100	.052	.060	.044	29.318	29.380	29.298	29.332
28	1	12	0	4⅓	100	?	100	.046	?	.044	29.306	29.380	29.303	29.330
29	10	10	5	8⅓	100	100	100	.068	.068	.055	29.296	29.403	29.358	29.352
30	3	23	11	24⅓	100	60	80	.050	.088	.060	29.356	29.276	29.306	29.313
31	13	22	19	18	100	86	100	.078	.106	.103	29.163	29.042	29.075	29.093
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	19°.74	95	75	91	.098	.117	.101	--------	--------	--------	29.186
Average ------------------------					87			.105			------------------------------			

for the Month of December, 1886.

Clouds.						Winds.						Registering Thermometer.		Rain and Snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain or Melted Snow.	Depth of Snow. Inches.
100	Nim.	70	Cu St.	00	--------	s	8	w	12	w	12	24	– 1	6 a. m.	3 p. m.	.08	1
10	St.	80	Cu St.	100	St.	w	12	n w	16	w	8	22	0	--------	--------	------	------
10	St.	100	Cu St.	100	St.	w	1	n w	3	n	3	27	– 4	--------	--------	------	------
20	St.	00	--------	00	--------	n	2	n	3	----	0	18	–13	--------	--------	------	------
10	St.	10	St.	100	St.	----	0	s	3	----	0	22	–11	--------	--------	------	------
00	--------	00	--------	100	St.	----	0	s	3	s	1	32	3	--------	--------	------	------
100	St.	10	Cir Cu.	00	--------	s w	4	s w	2	w	6	32	15	--------	--------	------	------
30	Cir St.	00	--------	30	Cir. St.	s	2	s w	3	s w	1	40	34	--------	--------	------	------
40	St.	40	Cu St.	100	St.	s w	1	s w	6	s w	8	40	35	--------	--------	------	------
50	Cir St.	40	Cir St.	100	St.	s w	16	s w	16	s w	12	48	35	--------	--------	------	------
100	Fog.	30	Cir.	90	St.	s w	5	s	4	s	2	50	34	--------	--------	------	------
80	St.	100	Nim.	100	Nim.	s e	5	s e	7	s	5	46	38	1 p. m.	--------	------	------
100	Nim.	100	Cu St.	100	St.	n w	12	n w	16	n w	12	40	27	--------	11 a. m.	.28	------
100	Cir.	100	Nim.	100	Nim.	s w	12	s w	6	n	1	30	4	10 a. m.	10 p. m.	.35	3
10	St.	100	Cu St.	100	St.	n w	3	n	12	n w	4	16	5	--------	--------	------	------
100	St.	90	Cu St.	100	St.	s w	1	s w	5	w	1	14	– 2		--------	------	------
30	St.	100	Nim.	100	Nim.	s	1	e	6	e	3	24	5	12 m.	12 m.	.25	3
100	St.	100	Cu St.	00	--------	n w	4	w	6	----	0	25	5	--------	--------	------	------
60	St.	100	St.	100	St.	s w	1	s w	12	w	12	25	0	--------	--------	------	------
20	St.	20	Cir Cu.	10	St.	s w	6	s	16	s w	1	28	0	--------	--------	------	------
100	Nim.	100	St.	00	--------	s w	2	w	8	w	3	35	6	--------	--------	------	------
100	St.	10	Cir.	00	--------	----	0	w	6	----	0	32	6	--------	--------	------	------
100	St.	100	Fog.	100	St.	s	6	s	2	n e	2	30	20	--------	--------	------	------
100	Nim.	40	Cu St.	100	St.	n	6	n w	12	----	0	31	4	3 a. m.	10 a. m.	.30	4
100	St.	100	St.	100	Nim.	n w	2	s e	8	n e	5	20	6	3 p. m.	10 p. m.	.25	2
100	St.	100	St.	100	Nim.	s	5	s w	4	s w	2	26	4	--------			------
90	St.	100	Nim.	00	--------	w	1	w	12	s w	6	10	– 2	--------		------	------
100	Nim.	100	St.	00	--------	s w	5	n w	12	w	4	15	0	--------	--------	------	------
100	Nim.	100	Nim.	00	--------	n	1	n e	2	----	0	10	-10	7 a. m.	8 p. m.	.15	1½
100	St.	20	Cir.	100	St.	n e	1	e	3	n e	3	23	33	--------	--------	------	------
100	Nim.	100	Cu St.	100	Nim.	n e	4	n	8	n	8	22	9	7a. m.	10 p. m.	.10	1
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	1.56	15½
70	--------	66	--------	70	--------	----	----	----	----	----	----	27.7	8.23	--------	--------	------	------

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